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Physics Teachers Learning Communities - From the Perspective of Teachers

Doctoral Dissertation

Submitted by Daphne Cohen-Brenner

Supervisor: Prof.dr.hab. Stanisław Dylak

Faculty of Educational Studies

Department of Pedeutology

Adam Mickiewicz University of Poznań, Poland

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Abstract

The physics teacher is generally forced to work alone, without a colleague from whom to seek advice and without a professional team. The answer is provided in the framework of a regional learning community, which invites a relationship with other teachers. The *objective* of the research study is to identify the mutual relationships between the nature of the learning that the interaction in the community develops and the manner of expression of the change in teaching in the classroom. The *research questions* at the heart of the study are as follows. What are the physics teachers' perceptions and what is their attitude towards the participation in the professional learning communities? What is the contribution of the professional community to changes in the contents and ways of teaching that occur among the physics teachers? What in the teacher's opinion are the factors of the effectiveness of the professional physics community? Did the change that occurs in the teacher following his participation in the community create a change in the students' learning?

The research study was carried out according to the qualitative paradigm, the aim of which is to document and to attempt to understand the research participants' unique and subjective world. This is a case study that means the documenting of a group of people throughout the process (Stake, 1995). The social context has considerable weight and the interpretation of the qualitative data must be carried out by a researcher who knows the society and culture on which the research is performed. In this case, the researcher is a part of the researched community, a fact that necessitates the use of triangulation.

The findings in the social context indicate that the teachers come to the PLC less from the academic need and more from the social need. The social learning is a 'power multiplier' that greatly strengthens the sense of professional satisfaction. The interaction with other teachers empowers the feeling that they belong to a knowledge-creating group that engages in shared activities, mutual assistance, discussions, and knowledge sharing.

Another issue that arose from the findings revealed that in the community there is a process of creating knowledge and not just receiving knowledge. The collective power

enables the creation of contents refined for the teachers' needs. The source of knowledge and the source of strength are the community teachers themselves. The teachers learn from one another, strengthen their sense of self-efficacy, and feel that they contribute and benefit at the same time.

The findings in the context of the students' learning indicate that the changes that occurred in the class were caused by the teachers' change of the perception of their role in teaching. They shifted the focus from practice and memorization to the creation of conceptual understanding and analysis and research skills. The findings indicate that there are many students whose teachers undergo a continuous process of change in their ways of teaching following their learning in the community.

The uniqueness of this research study is that it opens the classroom door of the teachers in the Paris Community and provides the possibility for the characterization of the community teachers' perceptions and feelings, as well as the interaction among them. If we believed like Bagno, Eylon, and Magen (2021) that the main goal of the teachers' coming to the community is the learning of new strategies and contents for the diversification of the teaching, then the present research study proves that the first goal is social and not scholastic. Teachers come to the community to be found in the company of other physics teachers who speak the same professional language (McLaughlin & Talbert, 2001). The learning grows from the reciprocal relationships and the social contexts between the Paris Community teachers, through the creation of a community experience and a feeling of partnership along the way (Eylon, Scherz, & Bagno, 2020).

The findings of the research study confirm that the meetings, every other week, month after month, year after year, caused the innovation of the ways of teaching of the teachers following the intensive exposure to the diverse teaching methods. They shifted the focus from the content they are teaching to the way in which they are teaching and to the experience they are creating for their students (Buabeng, Conner, & Winter, 2018).

1. Introduction

This research study is about The Paris Community as a Model for Regional Physics Teachers Learning Communities. The conclusions allow for the generalization of the learning characteristics of physics teachers who learn in a regional professional community and an accurate look at the project of the communities.

The physics teacher is generally forced to work alone, without a colleague from whom to seek advice and without a professional team. The answer is provided in the framework of a regional professional learning community (PLC), which invites a relationship with other teachers. The group learning enables the building of knowledge, mutual cross-fertilization, and creation of a "teachers' room" that constitutes a team on the regional level. The present research study engages in the community of physics teachers and attempts to examine the teachers' learning characteristics from their perspective.

The Paris Community was chosen to serve as a representative model for all twelve physics teacher communities operating in Israel. Since the researcher serves as a community leader in this specific PLC, there is the opportunity to interview the teachers, observe them during the community meetings, and collect data. The name of the community and the name of the teachers mentioned in this research are pseudonyms. The conclusions drawn from the Paris Community can allow for the generalization of the learning characteristics also in other PLCs and all the population of physics teachers who learn in a regional professional community.

The research study will try to identify the mutual relationships between the nature of the learning that the interaction in the community develops and the manner of expression of the change in teaching in the classroom. To bring up the research participants' feelings and insights about the effectiveness of collaborative learning as well as the implications of the change on the students' learning. According to Caena (2011), the teachers are the main factors in the students' learning. In addition, the research will examine the process that led to a change of the content knowledge of teachers in the Paris Community and the influence of the promotion of the teachers' knowledge on the students' learning.

Research studies indicate that physics is an especially challenging subject, which requires quality instruction and special attention to the personal learning process of every student. In many cases, these are requirements that the work environment in the schools find it difficult to fulfill. Some of the reasons are that most schools have a low number of teachers of physics, and sometimes only one teacher, and they must cope with many challenges that characterize the teaching of physics. Special knowledge is needed for the learning of this complicated scientific subject in an interesting and challenging manner that inspires enthusiasm. The learning environment obligates the increased depth of the teachers' disciplinary knowledge at the same time as the development of learner-focused teaching practices (Bagno et al., 2021; Darling-Hammond, Hyler, & Gardner, 2017).

It is necessary help student's experience significant learning that leads to successes. Current knowledge in the teaching of the sciences is necessary to create the relevance of the subject, so as to encourage students to choose physics and to understand the difficulties that the students experience. For this purpose, regional learning centers called 'Professional Physics Learning Community near the Home' were established around the country. Thus, the teachers can learn and develop in a center close to their residential area.

The objective of the 'Learning Communities'- Program is the professional development of the physics teachers. In this environment and in reciprocal cross-fertilization they will create knowledge through collaboratively planning. They will operate as active learners who carry out reflective dialogue for the purpose of professional growth and improvement of the teaching (Clarke & Hollingsworth, 2002; Eschar-Netz & Vedder-Weiss, 2021). The communities enable the single teacher to share experience and resources with peers, to know and experience 'learner focused' teaching, and to promote in a collaborative manner good teaching based on evidence from the classes (Marzel & Arica, 2021; Martinovic & Horn-Olivito, 2020).

The topic of 'learning communities' exists in many subjects, including mathematics for the middle school, English, chemistry, language, and literature. This research study will address physics learning communities because of my closeness to this topic, since I am a teacher of physics. In this paper, I will not enter into the field of physics itself since this is

only one example of many PLC'S. The research objective is to find a correlation between the improvement in students' learning experience and the fact that their teachers learn in communities (Bagno et al., 2021; Dogan, Pringle, & Mesa, 2016). Therefore, this research study is general for the teaching field and has no direct relation to physics.

This research study will address the physics teachers who participate in a learning community. The community of teachers is one of the ways for the promotion of the teachers' professional development. In Israel, as in the other developed countries, there is great interest in the professional development of teachers and following the decline in the number of physics learners, there is an interest in the teaching of the subject of physics.

As a joint supervision of Israeli professor and professor from Poland in this study, who can form academic cooperation between the Weizmann Institute in Israel and the A.M.U. University in Poland, while respecting the cultural diversity. Research cooperation is an important part of the university's globalization strategy of exchanging knowledge, thinking and sharing, in the spirit of international solidarity.

Research studies that were performed on the community of physics teachers in Israel address the development of a program for the training of teachers who are leaders of the community. The professional development of the leading teachers, community instructors, who convey contents to teachers in their community, has been researched (Levy, Bagno, Berger, & Eylon, 2018; Levy, Bagno, Berger, & Eylon, 2020). Another research study focused on the online community of teachers of physics (Avdor, Rheingold, & Kfir, 2010; Eylon, & Bagno, 1997; Eylon & Bagno, 2006; Eylon, Berger, & Bagno, 2008; Goldschmidt, 2010; Hans, Eylon, & Bagno, 2013; Kfir & Ariav, 2008; Kozminsky, Goldstein, & Simka, 2004; Kurland & Hertz-Lazarowitz, 2006; Vurgan, 2008).

The characteristics of the activity in a learning community of physics teachers itself has yet to be researched. The analysis of the characteristics of the Paris Community will allow the teachers who are leading the PLC to decide how to lead their community and what to expect from the teachers who are members in it (Marzel & Arica, 2021). The results of the research study are an important and significant layer of knowledge about the impact of teachers' learning in the professional community.

2. Theoretical Background

The chapter of the research literature presents the theoretical perspective at the basis of the present research study. The chapter focuses on five main topics. The first topic addresses the teaching of physics in the high school. The second topic presents different responses to the need for the teachers' professional development. The third topic addresses the project of regional learning communities. The fourth topic emphasizes professional communities of physics teachers, and the fifth topic focuses on the Paris Community as a test case.

The research study examines over the course of four years the perceptions of physics teachers of the change of teaching approaches during their participation in the learning communities project. Teachers who are in different periods in their professional career participate in the Paris Community, which constitutes a case study, and therefore the following theoretical review presents the research literature that engages in the teachers' perceptions of the teaching and their professional growth. This research study examines the project of communities of physics teachers that was established in the year 2012 as an initiative of the Weizmann Institute of Science. The defined objective was to enable teachers to develop in a protected, cultivating, and including environment. According to Etkina, Gregorcic, and Vokos (2017), the community is presented as an environment that enables reflective investigation of the teaching for the purpose of the advancement of shared values, the change of practices, and the creation of enthusiasm, desire, and a feeling of identity from the teaching of physics.

This test case will allow the identification of characteristics and learning processes in the Paris Community and the examination of the connection between the findings of this research study and what occurs in all the communities of physics teachers. Thus, it may facilitate the assessment of the factors that create an effective community of learners. The research literature holds that one of the significant factors is the feeling of collaboration among the teachers.

The interaction with colleagues whose professional experience is esteemed enriches the teachers and adds to the self-confidence and to the feeling of partnership along

the way and thus creates a learning community (Eylon et al., 2020; Wilson, 2013). The collective power created enables improved teaching and serves as a support group and basis for the investigation of the teaching practices (Darling-Hammond et al., 2017).

This research study examined in addition to the effectiveness of the community the professional development of physics teachers, as expressed in the changes that occurred in them in the perceptions and approaches that comprise their perception of their role as teachers. The researched program espoused a message of change, which means social learning through the regular and continuous support that will enable the teachers' professional growth (Bryk, Camburn, & Louis, 1999). Hence, the research focused on the description and analysis of the teachers' perceptions of their professional development through a look at the story of the Paris Community. In the qualitative research method, it is possible to produce from the private case general insights on social phenomena. In this research study, the analysis of the evidence focused on the attempt to find in it the place of the learning community in the teachers' life.

The practitioners in the field of education acknowledge the fact that in parallel to the researchers and experts who enrich the teachers it is necessary to also build specific knowledge that comes from the learning communities themselves. This knowledge relies on the specific expertise of teachers and instructors of the community and on their cumulative experience in the implementation of professional communities. The new knowledge can contribute to the practical and theoretical infrastructure of the PLC project. It develops and is built through the observation with a magnifying glass of the community and creates a common conceptualization and development of activity aimed at the learning teacher. The researching teachers examine their work and thus learn and develop themselves (Avdor et al., 2010).

The researcher in the present research joined this educational initiative from its third year, first as an observer and then as a community instructor. Over the years, it was realized that the project is succeeding, expanding, disseminating the contents to the target community, and receiving positive feedback.

The teachers are found in a personal relationship with one another and contribute to the group, but also the community contributes to all of its members. The mutual influence and the ability of people to meet the needs of one another reinforce the shared relationships and make the community important and meaningful (Scherz, 2018; Waldman & Blonder, 2020).

The researcher's participation as an instructor of the Paris Community enabled an internal look at the physics teachers and created a research opportunity. The challenge of leading a learning community at the same time as maintaining the academic development of its teachers will enable the researcher to collect data and analyze the teachers' professional growth.

The continuous stay in the researched place makes the researcher a part of the local vista (Gibton, 2001) and is commensurate with the qualitative research method. This paradigm makes it possible for the researcher to make her voice heard, to identify motivating emotions and thoughts, and to form general insights from the private case. The research is not quantitative and significant but is a story of the researcher, as she perceives it. In this case of the Paris Community, the research validity is derived from the benefit that the readers can derive from the story and its conclusions. If the readers can learn from the story or implement its meaning in the context relevant to them, then the research study has academic and practical value (Krenske, 2002). From the research study of the Paris Community, it is possible to conclude about the examined social phenomena. The discussion of the messages that arise from the community leads to a multidimensional and interdisciplinary look that connects all the PLCs.

The unique research methodology creates a correspondence between the research topic and the manner of research performance. Accordingly, the research presents a dual perspective, personal and collaborative, on the place of learning communities in the professional identity of physics teachers. The cross-referencing between the theoretical background in this chapter and the research findings enables a holistic view of the role of the PLC in the change of the approach of the physics teaching.

2.1 Teaching and Learning Physics Today, in High School

The educational system in Israel ascribes especial importance to the studies of the sciences in general and physics in particular to two primary objectives. According to the first, science education is designed to train students for life in an advanced knowledge and technology rich society that will contribute to the growth of the economy and the development of the country (Gilad, 2001). For this purpose, the cultivation of the human capital is necessary, to constitute the generation of the scientists of the future (Lawrenz, Wood, Kirchhoff, Kim, & Eisenkraft, 2009) and to give them the knowledge, tools, literacy, and ways of scientific thinking necessary for the citizens of the 21st century (Harari, 1992). According to this approach, the studies of the sciences are a basic need, without a necessary relation to the student's future occupation (Goldschmidt, 2010).

According to the second objective, scientific education is preparation for the future in the university and in industry (Hazari, Sonnert, Sadler, & Shanahan, 2010; Erinosho, 2013). Industry today, more than in the past, makes use of knowledge-rich technologies and needs quality skilled in the scientific subjects (Feinstein, Allen, & Jenkins, 2013).

The future students of Physics in the universities also require knowledge that will constitute the basis of the advanced knowledge that will be acquired in the university (Erinosho, 2013). As the level of the basic physical knowledge of the future student is lower, the university will need additional resources and a longer process of training. In addition, the absence of a base of knowledge in the sciences limits ahead of time the student's areas of interest and as a result the number of the learners of these subjects will be lessened (Hazari et al., 2010).

Education begins at the school and not at the universities, and therefore improvement in the students' learning is required, with the encouragement to learn in scientific programs, so as to create excellence in scientific education in general and physics in particular and knowledge-rich personnel (Sassi & Michelini, 2014; Lawrenz et al., 2009). Achievements and success in the school will encourage the student's efficacy and will direct them to the continuation of advanced studies so as to enrich their knowledge and to aspire to academic excellence (Harari, 1992). According to Tseitlin and Galili

(2005), the goal of the educational system is to acquire education for the social and intellectual functioning of society and not for the acquisition of a profession. Physics study form the basis for modern technology and thus enable higher intellectual function, as physics provides quantitative and analytic skills needed for high performance of analyzing data and solving problems **(**Van Heuvelen, 1991**).** Accordingly, the goals of the Physics teaching today are complex and include the development of skills such as thinking skills, argumentative skills, and critical thinking skills (Gautreau & Novemsky, 1997). Elevating Physics learning to that excellence, means creating a dynamic, innovative and inspiring learning environment (Eylon& Bagno, 1997; Guido, 2018)

Physics lessons, which are considered lessons led by diagrams and complicated equations written on the board, have changed (Erinosho, 2013). Today the teacher is required to have expertise in making the physics knowledge accessible in a relevant, interesting, and experiential manner that awakens curiosity, for the purpose of the creation of physical cognition (Guido, 2018; Timperley, Wilson, Barrar, & Fung, 2007; Van Heuvelen, 1991). To adjust the learning of physics to the goals, it is necessary to cultivate unique teaching approaches (Cohen-Brenner, 2017).

Physics teachers need to be exposed to innovative teaching methods, to practice and experience them, in a supportive learning environment, as in the example of the professional community (Levy et al., 2020; Levy, Bagno, Berger, & Eylon, 2021). Although the goal is physics students, the required work is change of the perception of the physics teachers, from the understanding that the teachers are the spearhead. If we change their outlook, then the change will more effectively penetrate into the classroom and to the students (Sassi & Michelini, 2014; Timperley, Wilson, Barrar, & Fung, 2008).

To provide the teacher with instruments for coping with these tasks, professional learning communities were created. Many physics teachers are exposed in the communities to innovative and experiential teaching methods that enable stimulus and growth (Eylon et al., 2020; Levy et al., 2020).

In this research study, we attempt to understand whether most of the community teachers adopt the methods and insert them into the work routine.

The proposed research study focuses on the physics teachers and attempts to focus also on the influence of the professional development of physics teachers who learn in a professional community on their students from a number of aspects. In the research study we will examine the improvement of understanding topics in physics learned in the content field by a teacher who participates in a professional community. We will try to understand the degree of interest in physics felt by students whose teachers professionalize in the learning communities, the motivation to choose physics, and the degree of satisfaction from the teaching of the profession. For this purpose, it is required to understand the distinctive characteristics of physics students.

Students who choose to study physics are identified as an exclusive group, since they consciously choose high targets, are willing to put forth considerable effort, are determined, are ready to persevere, and strive to succeed (Erinosho, 2013; Etkina et al., 2017). The physics classes are small and the students who learn there are a handful of the most talented students in the school. Many students study physics at a high level since they intend to study scientific or technological subjects in the framework of higher education (Lawrenz et al., 2009). Hence, they must establish their knowledge qualitatively and quantitatively in the fundamental areas of physics (Sassi & Michelini, 2014).

In the framework of the studies of physics, the students are supposed to recognize scientific models, examine their development, understand through them different phenomena, and engage in aspects of theory and experimentation and the reciprocal relations between them (Buabeng et al., 2018; Van Heuvelen, 1991). They must know to use a variety of representations and to know their relative advantages, to be aware of the extensive use of mathematics, computers, and modern technology in the framework of physics while coping with the analysis of different physical scenarios (Gautreau & Novemsky, 1997). In addition, they must know fundamental concepts in the main areas of physics, obtain a general picture of the broad relations between the different branches of physics, and learn a little about the reciprocal relations with other sciences – technology, humanities, morality, and society. Aside from the required knowledge, the studies are supposed to develop skills of thinking and learning (Sassi & Michelini, 2014). Of what was uttered, we can understand that the skills required to students of physics, also require

special teaching methods by teachers trained specifically to do so (Erinosho, 2013; Timperley et al., 2008). This cause was one crucial factor in founding the professional communities in Israel.

2.2 Teachers' Professional Development

The professional development of experienced teachers, like new teachers, has constituted a challenge to the educational system from its beginning (Michaeli & Sommer, 2014; Yerushalmi & Eylon, 2013). Referring to the programs of development and effective training for the science teachers, a number of main characteristics were found that should be addressed, including focus on the specific scientific material during the training (Eylon & Bagno, 1997), active involvement of the teachers during it (Harrison, Hofstein, Eylon & Simon, 2008), and adjustment of the training to the policy and practices customary in the school (McLaughlin, & Talbert, 2001). The training must be characterized by innovation, must focus on the study materials that will interest and challenge the teachers (Little, 2002), enable inquiry learning (Timperley et al., 2007), present different models of such learning, and take into consideration the feeling of physical and emotional welfare (Darling-Hammond et al., 2017; Wilson, 2013).

In addition, on the topic of in-service training of the teachers, for the purpose of professional development in the areas of science and mathematics, it is necessary to emphasize long-term in-service training and guidance courses (Eylon & Bagno, 1997; Harrison et al., (2008), which will also include reference both to the disciplinary content and to the pedagogical perception of the teachers, with an opportunity for the teachers to research, discuss and experience themselves what they are intended to teach (Michaeli & Sommer, 2014; Little, 2002). As a part of the same significant and continuous training, it is necessary to develop a supportive and stable community and to support the teachers in the field over time (Kim, Miller, Herbert, Pedersen & Loving, 2012; Little, 2002). This is especially significant when there are new teachers who should be promoted in a continuous manner and the teachers should be seen as partners in the planning and making of pedagogical decisions (Eshchar-Netz & Vedder-Weiss, 2021; Kfir & Ariav, 2008).

It should be summarized that the supra-goal of the training and development of the teachers is the achievements of the students who are being educated – cognitive, emotional, and value-oriented achievements (Dogan et al., 2016; McLaughlin & Talbert, 2001). The fulfilment of the abilities and the skills of the teacher as a professional will provide a solution to the needs of the students as individuals and to the needs of the system in its commitments to products towards the public of its clients. The entire process leads to these products and it is its test (Avdor et al., 2010).

2.3 Learning Communities of Teachers

The professional development of teachers obligates the creation of frameworks of continuous professional support over time that will serve as a 'home' to which the teachers will come regularly and where they will encounter current knowledge (Gilad, 2001). They will attempt in the framework of this 'home' experiential processes of teaching-learning, with the translation of educational ideas into learning activities that will be performed in actuality in the school (Gilad, 2001: Little, 2002). In this 'home', the teaching staff works together, as one professional community that constitutes a main link for the promotion of the learning and enables teachers to develop continually (Bryk et al., 1999).

According to Lieberman and Pointer (2009), a professional community of teachers is a group of teachers with shared objectives, which focus on professional issues and invites learning, activity, and work in teams (Kim et al., 2012). Learning in groups enables the sharing of ideas, problems, and solutions, through the investigation of the learning processes in scientific methods (Anderson, Greeno, Reder, & Simon, 2000; Etkina et al., 2017) and enables reflective dialogue on the practices of teaching and learning of the students (Bryk et al., 1999; Clarke & Hollingsworth, 2002).

According to McLaughlin and Talbert (2001), the professional community is a unique social unit in which the teachers will act as a team of peers learning, creating, developing, and promoting educational initiatives through reciprocal cultivation, when the final product is directed at the students' learning. According to Caena (2011), there is a relation between the quality of teaching and the students' learning (Cohen-Brenner, 2017).

If teachers want to improve their teaching, it is recommended for them to learn in a professional community (Kim et al., 2012).

The teacher's learning process is a constructive process (Geijsel, Sleegers, Stoel, & Krüger, 2009) and in the professional community with shared values and a shared vision the teacher can have personal and collective professional learning through support and cooperation (Borko, 2004; Kim et al., 2012; Vossen, Henze, De Vries, & Van Driel, 2020). The community teachers focus on professional ideological investigation and evince collective responsibility for the learning of the students, through openness, reciprocal trust, and respect (Bolam, McMahon, Stoll, Thomas, Wallace, Greenwood, Hawkey, & Smith, 2005). The community in which the teacher learns shapes the way in which the teacher sees the world and the way in which he teaches (Putnam & Borko, 2000) and therefore a strong professional community cultivates learning abilities for teachers and praises their teaching (Borko, 2004).

Teachers' learning process in the community grows out of the approach that professional development constitutes an ongoing continuum of learning (Avdor et al., 2010; Vurgan, 2008), which begins in the stage of the training for teaching and lasts over the teacher's entire life. Hence, it is necessary to develop initiatives for the creation of learning communities throughout the continuum of the teacher's development, when in every stage of the framework, the goals, the form, and the content of the learning communities will be adjusted to the stage in which the teacher is found over the axis of his development (Gilad, 2001).

According to Kurland and Hertz-Lazarowitz (2006), professional learning communities grew on the background of the need to prepare teachers and students for coping with standardization, multiculturalism, globalization, and the knowledge era. In a broader sense, this is a group of professionals who examine together their knowledge and discuss it with the goal of developing professionally and improving their expertise and the students' achievements (Kozminsky et al., 2004; Waldman & Blonder, 2020).

The community members have a shared vision, they support one another, and they work as a group in collaborative teams for the fulfillment of the vision and the achievement of the joint goals (DuFour, DuFour, & Eaker, 2006; Little, 2002).

One of the characteristics of the learning community of teachers, which differentiates it from teamwork, is the examination of the result – improvement of the practice of the teachers and the students' learning (Vescio, Ross, & Adams, 2008) and choice of the field of specialization of students. A learning community is a community of action that focuses on learning (Reimann, 2008). Research studies show that learning communities of teachers can improve the practice of the teachers (Borko, 2004) in the context of the teachers' learning and their students' achievements and even the choice of the students' field of specialization. Vescio, Ross, and Adams (2008) indicate the need for a research study that will document the activity of the professional learning communities and their influence on a variety of aspects related to the practice of the teachers and the students' learning.

The participation in the PLCs improves the teachers' ability to critically and reflectively examine the practice and encourages professional growth and improvement of the teaching processes (Borko, 2004). The effective professional development of teachers in a community enables cooperative learning relevant to practice and is based on processes of inquiry and reflection. Innovative perceptions and advanced ways of teaching are the aim of the professional development and are an integral part of the practice (Scherz, 2018). According to the perception of the PLCs, it is not possible to disconnect between the teachers' learning in the communities and the practice in the classrooms. It is necessary to change the paradigm that addresses professional development and instead to engage in professional learning. According to this perception, it is possible to see the teachers as a source of knowledge for the leadership of change and the taking of professional responsibility for the betterment of the teaching. In addition, the teachers must direct their teaching as a "learner-focused" approach (Eylon et al., 2020).

In the learning communities the assumption is that the professional knowledge is found already among the teachers and it is necessary only to reveal it through reflection

with other teachers. Another assumption is that active participation in the community will strengthen the teachers' professional knowledge and thus improve the students' learning in the classroom.

Martinovic and Horn-Olivito (2020) also strengthen the perceptions of the PLCs and maintain that teacher professional learning is not a straightforward process. Teachers have unique viewpoints, agendas and beliefs. Even before they come to the communities, most of the teachers already have context-based pedagogical knowledge and professional experience. In shared discussions and reflection teachers can probe the knowledge embedded in the wise teaching decisions of others. Furthermore, they can deepen their own knowledge and their own abilities to make wise decisions in the classroom.

Hence, the PLC model provides opportunities for teachers to share with peers their knowledge-of-practice. The teachers improve the knowledge in physics and the knowledge in teaching physics through the creation of a culture of learning and shared deliberation (Little, 2002). The professional learning community is the place where the teachers share with their colleagues the knowledge of practice and theoretical knowledge.

An opportunity is given here to examine, while discussing, the knowledge inherent in the wise teaching decisions of their colleagues who engage in the same professional field. Furthermore, learning is considered a social activity that happens continuously over time. The collaboration becomes over the years more and more meaningful, until the community becomes part of the teaching of a teacher who develops and re-examines his teaching (Bryk et al., 1999; Lieberman & Pointer, 2009; Waldman & Blonder, 2020).

In learning communities, they are aware that the teaching is a dynamic process that changes in every lesson and even during it. Hence, it is necessary in the community to examine again and again the pedagogical approaches and to adjust them to the changing reality. For experienced teachers, it is not at all simple to change the ways of teaching and pedagogical approaches. Only in an effective community in which the relationships between the community members are supportive is there trust and confidence between them, and thus it is possible to leave the zone of comfort and attempt new things (Waldman & Blonder, 2020). The learning in the community gives the teacher innovative and

research-based tools that have a great and sometimes even dramatic influence on the students' learning (Bagno et al., 2021).

The PLCs are led by two instructors and act under the auspices of an academic organization in the field of knowledge. In this research study, the academic support is provided by the Department for the Teaching of Sciences in the Weizmann Institute of Science. This model of instruction is hierarchical but multidirectional. The academic organization trains teachers of teachers who will be the leaders of the different communities. The instructors are exposed to innovative differential content that includes teaching strategies, skills, and content knowledge, alongside instruction skills of learning communities. After the contents are examined by the leading teachers, they are implemented in the framework of regional communities and are exposed to the criticism of the teachers of the community (Marzel & Arica, 2021). Insights and improvements that come from the regional communities are presented in the community of the leading teachers and after the approval of the academic organization they are distributed to all the teachers. It is possible to see that in this multidirectional model the contents move up and down the fan and there is no monopoly on knowledge. The leading teachers learn in their supportive framework and then can lead groups of teachers of their own. In this model, which is called "Train the Trainer", training is provided only for a small group of teachers and these teachers train their colleagues and convey to them the contents that they learned (Martinovic & Horn-Olivito, 2020).

So that the communities will be meaningful, they need to focus only on two objectives: the learning of the students and the creation of a supportive environment for the teachers that enables growth through collaboration. The professional communities in which the teachers learn are not the goal itself but are the means for the achievement of the goals. Hence, the effectiveness of the PLCs is measured both according to their influence on the teacher's professional development and according to their influence of the final goal, which is the students (Bolam et al., 2005).

The community increases the effectiveness and efficiency of the teachers' work, strengthens their confidence, and encourages them to be open and involved actively in the

efforts to improve and change their ways of teaching (McLaughlin & Talbert, 2006). An effective professional community that operates well will help to the focus of the goals of the group as well as to establish relations of trust and reciprocal respect between the colleagues. These factors contribute to the effectiveness of the teachers in their work (Bolam et al., 2005; Waldman & Blonder, 2020).

Six main elements are required that are essential in order to enable the creation of a strong and effective community of teachers:

1. The Sense of Community. The members of the professional learning community feel belonging to the group. A personal relationship between the teachers and an honest partnership that helps the creation of the social fabric necessary to learning are created.

Cooperation that focuses on the teachers' learning as group learning and personal and professional learning – The community teachers present their teaching method and discuss with their colleague's different approaches to teaching, all this in a supportive and nonjudgmental atmosphere. The teachers evaluate their colleagues' professional experience, respect the different teaching methods, and mutual influence is created. In the regular time slot, "From My Class", teachers present the course of the teaching and the colleagues provide feedback on the lesson through a discussion on the shared problems. An effective community is a framework for continuous learning, in order to improve the teachers' professional practice, through the sharing of the teaching practices in the classroom (Scherz, 2018). The final goal of the teachers' learning in the community is to promote the students' learning. When the teachers use creative methods and diverse ways and implement the contents they acquired in the community, they encourage meaningful learning that may improve the students' approach to the profession and their learning experience. Therefore, they offer the students learning and success (Hattie, 2012). In an effective community the teachers influence their colleagues and their environment and learn from one another's experience. The teachers are given the ability to promote their professional learning with the contribution to the processes of the professional learning of their colleagues in the community. A professional learning community in which there is a

strong sense of community creates reciprocal relationships that enable trust and joint experience (Waldman & Blonder, 2020).

Sense of community – In the effective community, the sense of community and belonging is high, and the teachers feel that they contribute and are contributed to simultaneously. Proper planning of the community meeting will always begin with activity that has the goal to create a sense of community, to break the ice, and to make a collection of teachers from different schools into a cohesive group with a shared goal. Here the teachers are invited to bring up events that they want to share with the community group.

In this way, it is possible to bring people closer and to create a close, true, and direct system of relationships among the community members. The PLCs bring closer teachers who share the same feelings, problems, and professional difficulties and the support allows them to continue to improve and advance professionally (Anderson et al., 2000; Kozminsky et al., 2004). The community meetings create renewed enthusiasm from the teaching and give a sense of belonging to the place in which knowledge, partnerships and professional development are created. Similarly, it is possible to rely on Grossman, Wineburg, and Woolworth (2001) and Waldman and Blonder (2020), who describe PLCs as an environment in which the teachers create community relationships, search for a shared language, and develop the social relations. As the system of relationships between the community members becomes dynamic, the trust, respect, and mutual appreciation are strengthened, and the social resources that the community members share develop and broaden (Bryk et al., 1999).

2. Vision, Goals, and Shared Values. The teachers of the community share an educational vision, values, and shared norms. They engage in professional learning in order to advance the students' learning (DuFour et al., 2006).

In the effective community, the teachers aim at a common objective, in order to create the best teaching. The teachers analyze the students' work, derive insights and interpretation from the emerging data, and discuss how to improve the teaching on the basis of these data. Collaborative learning and follow up after the implementation are carried out. In the shared vision, the community sets for itself the goal of improving the students'

learning (Little, 2002). For this purpose, indices of success that can be evaluated and connected directly with the objectives are determined. The community members plan, learn, and implement contemporary teaching strategies and form over time a joint perception of the best teaching. An effective community maps its needs, defines its goals and ways of conduct, and shares materials, while advancing personal and collective learning. Consequently, extensive social relationships are created among the community teachers (Grossman et al., 2001).

The teachers of the professional learning community have an identity defined by a common knowledge field, teaching skills shared by the field of knowledge, and commitment towards the field of knowledge (Etkina et al., 2017; Eylon & Bagno, 1997; Eylon et al., 2020). The teachers feel they are a part of a community with a shared goal and created a system of relationships that enables them to learn from one another and to create shared tools of norms and skills that support the level of knowledge and expertise of the teachers and others in the community. They are proud to learn from one another, esteem their colleagues, the community members, as creators of knowledge, and thus build a respectful, appreciative, and empowering system of relationships. The PLC members feel that they belong to a group that creates knowledge and engages in shared activities, mutual assistance, discussions, and knowledge sharing (Harrison et al., 2008).

The vision of the community in social terms is to strengthen the openness, the cross-fertilization, and the interaction between the leading teachers and their community, between the teachers of the community and their colleagues, and between the teacher and her students. All this is done with the goal of causing the community to be a place of openness and trust, a place where the participants feel confident to be exposed, to dare, to help one another, and to learn. The teachers share their experiences, difficulties, and successes and thus learn from one another (Darling-Hammond et al., 2017).

The vision of the community from the professional aspect that engages also in the challenges of physics has as one of its objectives to promote the implementation of the student-focused teaching strategies. The combination of the social and professional vision

proves that the community is a place that enables the teachers to examine through the cooperation with their colleagues their students' learning and their own ways of teaching.

To conclude, in the effective learning community the shared vision is the success of the students' learning. For this purpose, the teachers examine together and constantly their practices with the shared aim of improving professionally (Scherz, 2018).

3. Sense of Influence. When the teachers contribute to the group, they feel they are necessary. When the community contributes to the teachers, the community becomes necessary for them. This element has two-way influence.

In the effective community, the influence on the teachers' ways of teaching will result in influence also on the nature of the learning in the class and on the students' learning. The participants have a sense of belonging to the community, a sense that all the members are important to one another and to the entire group. There is the shared belief in that the members' needs will be answered through their commitment to be together (Martinovic & Horn-Olivito, 2020). One of the influences and meaningful contributions is the knowledge created from the teachers' collaborations and moving in the network of the communities. This content knowledge is exposed to the criticism of many teachers and undergoes improvement and strengthening until the creation of a final version in which there is significant knowledge that met the test of the outcome. In the community innovative teaching strategies that require adjustment are learned and implemented. An effective community contributes to teachers in the assimilation of the contents through methodical and spiral repetition of the innovative methods. According to Yerushalmi and Eylon (2013), when classroom teachers introduce curricular innovations that conflict with their former deeply rooted practices, the teachers themselves experience a process of change. The community is necessary to enable the change and to instill confidence in the teachers that they are able to apply what they have learned. An effective community provides a professional solution to the natural fear of change. The slow and consistent assimilation supports the teachers and encourages them to attempt in their classes effective pedagogical strategies. Teachers who share with their colleagues the attempt at implementation and the lessons they derived after the implementation of the strategy lessen

their concerns. The sharing teachers contribute to the group from their experience and instill confidence to dare to leave the comfort zone and to try proven strategies. According to Eylon et al. (2020), the academic and pedagogical knowledge built contributes to the in-depth learning as well as to the internalization of the new processes.

An effective professional community that focuses on the students' learning and relies on the contribution of the colleagues creates a feeling of necessity and importance. The analysis of the events from the class, the formation of shared teaching perceptions, mutual assistance for the improvement of the teaching, and construction of routines of monitoring learning contribute to the entire group and make the community an influential and necessary platform. The most important influence that must be addressed is the learning of the students in the class with specific reference to the learning of physics, which is the topic of the present research study.

The change in the ways of teaching that the teachers adopt for themselves in a long-term in-service training course in the community will penetrate into the classroom and create a greater depth of understanding and increase in the number of students interested in learning physics (Levy et al., 2018). Teachers who will internalize the learned contents in the community will innovate and diversify their ways of teaching. They will engage in the teaching of physics in a way that will inspire interest and curiosity and can contribute to the understanding of the topics learned and the entire learning process (Guido, 2018). This is commensurate with the research literature, in which teachers reported that the number of students in their class who chose to learn physics grew following the changes they carried out in their ways of teaching and attributed this to their participation in the professional learning community (Levy et al., 2020).

4. Sense of response to the professional need. In the strong community the teachers provide one another with the required professional need. An important professional need is to obtain reinforcements from the colleagues for the creation of pedagogical and professional confidence.

In the communities, there is focus on the promotion of the teachers' learning through the intelligent use of the colleagues' strengths. Each one of the teachers in the

community has a professional uniqueness with which they can enrich and strengthen their fellows in the community, the community culture, and mainly their self-confidence. In this way, an opportunity is created to strengthen their sense of self-efficacy and their belief in their ability (Waldman & Blonder, 2020).

A response to the professional need can be found also in the consultation and active discussions on the new contents. The pedagogical idea that lies behind this pattern of action is that the community teachers have peers with whom they can share the implications and experiences in the implementation of the new contents. These characteristics create an atmosphere of change and facilitate the teacher's practice in the introduction of the changes into the classroom (Clarke & Hollingsworth, 2002).

The teachers in the PLC are active learners who shape their professional growth through reflective participation in the program for professional development. Every teacher is an independent learner who comes with professional experience to the collaborative community that serves as a nurturing learning community (Levy et al., 2021).

The community environment allows the teachers to cooperate, practice, reflect, and learn from peers on topics that are important and relevant to them. The joint learning in the community is a process of the creation of knowledge and not only the receiving of knowledge and this is the meaningful innovation, in contrast to the regular in-service training in which the instructor is the source of knowledge**.** An opportunity is created to strengthen the teachers' sense of self-efficacy and their belief in their ability (Waldman & Blonder, 2020). The meetings of the community constitute for the teachers a support group in which it is possible to draw strength, unload difficulties, and consult on professional content without fear of criticism. A professional social fabric is created through discussion and exchange of tips about the little problems that the teacher experiences in his class (Eylon et al., 2020; Waldman & Blonder, 2020).

The effectiveness of the professional learning community is expressed in the refreshing and changing of the way of teaching of the physics teachers, who are required to be involved in the learning process in order to create change (Harrison et al., 2008). Every single teacher brings with him different knowledge and with shared strengths the

collective knowledge of the professional learning community is shaped. The consistent experience and the colleague support create in the end the desired change in the ways of teaching that is the objective of the PLC. The ongoing experience in the context of the teaching in the class and the continuous support are vital components in the programs for professional development in order to allow the teachers to change their teaching practices (Eylon & Bagno, 1997).

5. Sense of emotional connection. *The community members feel a common commitment and share a common belief - they have a feeling of support, openness and partnership*. The teachers in an effective professio nal community are characterized by persistence, enthusiasm, a sense of mission, aspiration to excellence, desire, commitment to the community, desire to belong, to act, to influence, and to develop together (Scherz, 2018).

Mutual trust, support, and mutual respect – Trust and respect reign among the community members. They support one another. An effective community is a safe space that enables learning and professional development with mutual and professional respect. The community is an emotional and professional safety net in which an opportunity is given for challenging experiences through support and accompaniment. The teachers define shared norms and values for the group cooperation, through respect and trust between the community members. In the community there is a respectful and participative discourse in a protected and safe environment.

Shared responsibility for the students' learning – In an effective community, the discourse needs to focus on the students' learning and the relationship between the students' learning and the teacher's mode of teaching. According to Bolam et al. (2005), the collective responsibility for the students' learning relies on the fact that there is a collective objective for all the group members for the creation of activities that focus on learning through cooperation. The learning of the teachers in the community is the means for the achievement of advancement and improvement of the learning of the students in the class. The teachers discuss and conclude according to the evidence and in the end carry out changes in order to improve their teaching and their students' learning. The community teachers take responsibility for their processes of learning and teaching and for the

leadership of the change themselves. The collective focus on the students' learning serves as an indicator of the mutual commitment that exists between the teachers and the success of their students' learning. According to McLaughlin and Talbert (2006), the achievements of students whose teachers participate in the professional learning community are commensurate considerably with the achievements of the students whose teachers work in isolation. As the teachers bear greater responsibility for their students learning, they discover that the new practices they implemented benefit their students. In addition, their sense of efficacy increases and they feel more effective (Timperley et al., 2008).

Professional reflective investigation of the teaching – The community teachers examine methodically the different theories and perceptions of the teaching and the outcomes of activity in actuality in their classrooms. They improve the professional knowledge through the creation of a culture of learning and joint deliberation (Little, 2002). The reflective examination is a part of the professional development of the community and a part of the process of the community's investigation of the community itself. In an effective community there is a constant reflective dialogue between the teachers on the educational issues. In the professional dialogue they examine critically their practice versus the objectives they set for themselves as a goal. The reflection on the practice and ways of teaching advances constant self-examination of processes and the drawing of lessons from failures and successes (Martinovic & Horn-Olivito, 2020). There is repeated reflection on the students' learning, the teachers' teaching, and the relationship between them.

6. Collaborative and supportive leadership and a regular mechanism. A necessary element in the success of the community is the existence of collaborative leadership that supports the activities of the community and the teachers. Another element is the regularity of the meetings.

Regular mechanism for teamwork – In an effective community, it is necessary that there be meetings in a fixed place, regularly, at a regular frequency, at regular times, comfortable physical conditions and known behavior norms. Every community has two leaders; whose role is to support the teachers in the assimilation of the contents learned in the community. The academic support of the scientists of the Weizmann Institute inspires

security and provides further support. The mechanism of the regular implementation and the accompanying leadership also enable teachers who come from different professional backgrounds to build together their knowledge. The platform of the professional learning communities is an excellent platform for the improvement of the personal pedagogical knowledge of every teacher and the collective knowledge of the group (Vossen et al., 2020). The regular mechanism of teamwork is the basis for the creation of stability and regularity, without which significant learning is not possible. The framework of the learning communities grants security, conveys commitment and seriousness, and constitutes a platform for professional growth. The regularity creates the effectiveness – best learning practices will exist if the regular times, the proper frequency, and the conditions enabling learning are preserved (Scherz, 2018).

The supportive leadership of the leaders and the academic backing – enable the preservation of the safe space in which the community is a stage for cooperative learning and the raising of the ideas through the reinforcement, encouragement of the motivation, and shared thinking. The frequency of the biweekly meetings enables effective learning. The meetings of the community are structured ahead of time and have declared goals known to all. Despite the flexibility for providing an answer to the needs that arise from the field, the topics in the academic part are determined ahead of time by the academic leadership (Eylon et al., 2020).

Collaborative leadership – Both the community leaders and the teachers are responsible together for the feeling of shared leadership. They hold relationships of trust that enable learning circles through the creation of a feeling of belonging to the community and the formation of the professional community. The instructors and the teachers together, in shared leadership, create the community, which becomes a place in which it is possible to ask questions, discuss, and obtain answers. In a cohesive community where teachers also bring content, there is an opportunity for learning, updating, rejuvenation, and enrichment through cross-fertilization. There is a positive correlation between shared leadership and a feeling of growth and change under the influence of the partners in effective learning (Berger, Eylon & Bagno, 2008; Eylon & Bagno, 2006; Eylon et al., 2020).

The shared leadership appreciates not only the leaders' knowledge but also the knowledge of each and every one of the teachers in the community, both as an individual and as a member who contributes to the group. The effectiveness of the professional learning community is because it is a body of knowledge and a support network with social and professional capital. The shared and continuous learning enables mutual cross-fertilization, as well as a feeling of belonging to the place where the knowledge, partnerships, friendships, and professional development are created, in accordance with the idea that the teachers' communities are a place for the improvement of the practice through continuous and collaborative learning (Grossman et al., 2001). Simultaneous with changes in the knowledge of the teachers and practice, the sense of shared leadership abilities, responsibility, and collegiality in the community are strengthened. The teachers experience research-based learning, scientific argumentation, and learning for the purpose of assessment, until they become experts and obtain a new perspective on teaching through shared learning in the community (Dogan et al., 2016).

The shared leadership in which the teachers build collective knowledge will provide inspiration for additional learning and new ideas. When the teachers are involved actively in their teaching process they improve their knowledge through the creation of a culture of learning and shared deliberation (Michaeli & Sommer, 2014). A community that succeeds in creating shared leadership will enjoy more responsible and dedicated teachers, who share knowledge, are effective, and are satisfied with their participation in the community.

To conclude, an effective professional learning community has the capacity to promote and sustain the learning of all professionals in the community with the collective purpose of enhancing student learning (Bolam et al., 2005).

As a result of the participation in the community, among the physics teachers a change in approach is created that caused a change in the classes, and as proof the number of physics students increased and the way of teaching, the strategies, the approaches, and the atmosphere in the class changed (Levy et al., 2020).

The professional learning community will be effective when there are at least six guiding principles as detailed above. In the optimal community, there is a spirit of

collaboration, constant learning, and action research. It is necessary to acknowledge the fact that the change in the teaching practices will be possible only when the changes are implemented during the continuous learning so that the doing and learning are intertwined. There must be a cycle of learning with the following components: learning, planning the teaching on the basis of the learning that was held, implementation, and reflection on the implementation. Only in this way will the community be effective and the changes in the practice penetrate also into the classrooms. In an effective community the group "is put at the center", and the attempt is made to change the perception with which the teacher came, in which the teaching is autonomous and individual work (DuFour et al., 2006).

The collaborative team is the fundamental building block of a professional learning community. The community atmosphere creates a feeling of partnership towards the colleagues, the profession, the community, and the shared goals. *This is an internal sense of identity and belonging since the teacher is a part of a large whole and the whole is greater than the sum of its parts* (Marzel & Arica, 2021).

2.4 Learning Communities of Physics Teachers

For the purpose of professional development of teachers, the Supervision of the Teaching of Physics in the Ministry of Education and the National Center of Physics Teachers operate a unique framework of 'Regional Learning Communities' in which the teachers develop professionally (Eylon & Bagno, 1997; Grossman et al., 2001).

Once every two weeks, throughout the entire school year, the teachers meet for four hours, during which they attempt innovative research-based teaching strategies, which address learning difficulties (Gilad, 2001). Using diagnostic questionnaires, the teachers become aware of the learning difficulties of students in diverse content topics (Eylon & Bagno, 2006; Berger et al., 2008).

In addition, they bring evidence from their classes of the findings of the questionnaires that they distributed to their students and attempt to find ways of treatment for the coping with the students' difficulties (Berger et al., 2008). In these communities the

teachers are updated with the innovations in teaching physics, enrich the professional knowledge, attempt new teaching methods focused on the learning of their students, share professional ideas, and develop teaching materials suited to their students (Eylon & Bagno, 1997; Scherz, 2018).

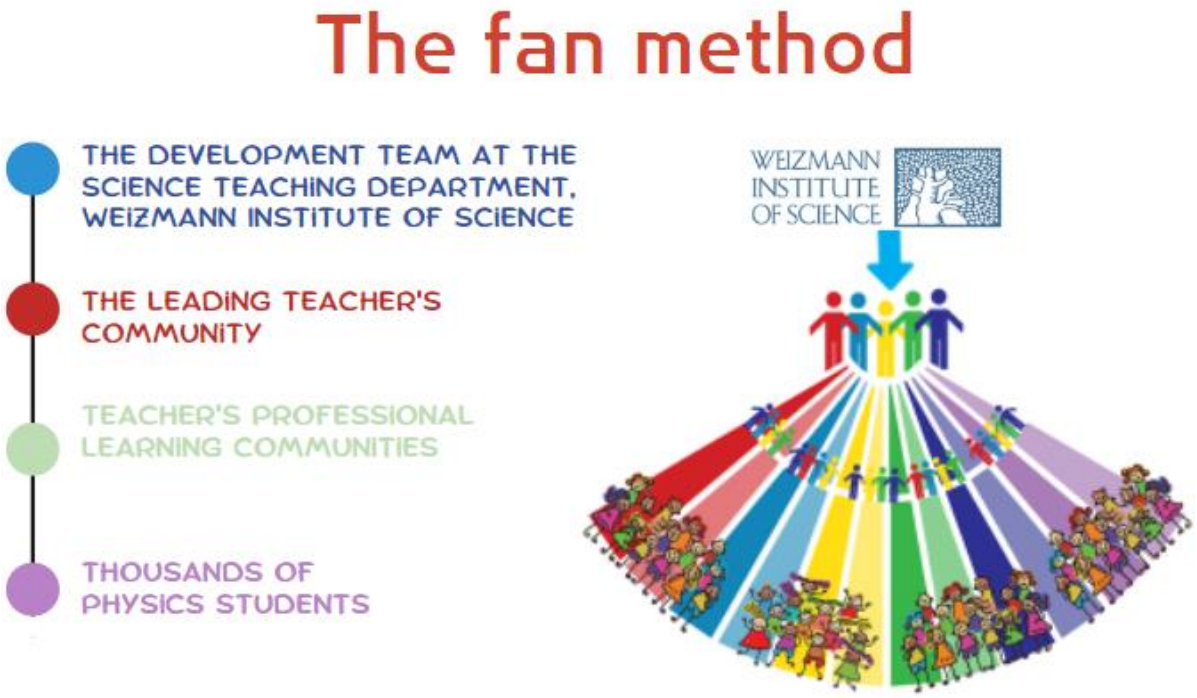
A teacher who instructs the community of teachers is called in the professional jargon a teacher- leader (Michaeli & Sommer, 2014). The teacher-leader, in collaboration with another teacher, guides a group of about twenty teachers who meet once every two weeks in the region of their residence (Hans et al., 2013). The meeting is generally held in the school, in the physics laboratory, and lasts about three and a half hours (Gilad, 2001).

The Science Teaching Department in the Weizmann Institute of Science, along with the Supervision of the Teaching of Physics in the Ministry of Education, develops the contents of the activity in collaboration with the teachers (Hans et al., 2013). In addition, the teacher- leader, instruct and support the communities so that they will succeed in the distribution of the contents to the teachers who are members of their community (Eylon & Bagno, 1997, 2006).

The instruction of the teachers in the regional communities is performed in the **fan method, in which a teacher teaches a teacher. A supra-instructor teaches the teacher-leader, who coaches teachers** (Hans et al., 2013). Experienced physics teachers receive their training in the leading of communities in the Science Teaching Department in the Weizmann Institute (Eylon & Bagno, 1997). These leading teachers instruct a regional community, in which many teachers are members (Levy et al., 2021).

Each of the teachers in the community assumes upon themselves the knowledge they acquired and conveys it to their students (Hans et al., 2013). In this way, in essence a broad coverage of **the knowledge is created and it is conveyed to thousands of students (**Michaeli & Sommer, 2014; Gilad, 2001).

Figure Number 1: The Fan Method of Knowledge Transmission



Source: Own Work, Based on the Program from the Weizmann Institute of Science

The main objective of the physics teacher's community is to help teachers support the learning of more students in the physics programs in the high schools. The teachers who participate in the communities share with one another innovative and creative ideas and give and receive professional support from peer teachers (Harrison et al., 2008). The teachers' interactions with one another influence their practice (Hayton & Spillane, 2008). The program of the meetings includes getting to know 'learner focused' teaching methods that address students with different abilities and needs, diversification of the teaching so as to create enthusiasm and attraction to the subject, and increased depth of the knowledge of physics and of teaching physics (Eylon & Bagno, 2006). The instruments given in the framework of the community of physics teachers direct everybody towards a shared goal, to broaden the ranks of the students who choose, persevere in, and succeed in the studies in the physics program (Hans et al., 2013).

In the community of physics teachers, the teachers collect and analyze data and examine evidence regarding the connections between the practice and the products of the

learning of their students, draw conclusions according to the findings, and make changes, with the goal of improving their teaching and the learning of the students in their classes (McLaughlin & Talbert, 2006). Teachers see great professional importance in the focus on the students' learning, but for this purpose they must first of all be learners themselves (Martinovic & Horn-Olivito, 2020). The teachers evince considerable dedication and caring towards the students. They believe in the ability of each and every student to learn and feel a collective sense of responsibility for the students' achievements (Bolam, et al., 2005; Louis & Marks, 1998; Louis, Marks, & Kruse, 1996).

The managers of the program of the communities of physics teachers, Dr. Esther Bagno, Senior Staff Scientist and Professor Bat Sheva Eylon, the head of the Science Teaching Department at Weizmann Institute, have a vision that within a few years' different types of physics communities will be established throughout Israel, to provide an answer for every teacher through a community that suits his needs (Hans et al., 2013).

In the context of the professional development, Eylon (2008) maintains that a strong pedagogical community of teachers can serve as a core and address for consultation and professional development, which new teachers can join. In essence, she holds that the investment in experienced teachers is in actuality also investment in new teachers. According to Eylon, the teachers' communities fill for the teacher a significant role in the existence of a group of reference, exchange of ideas and experiences, acquisition of practical knowledge, and joint learning (Eylon & Bagno, 2006). In the framework of the communities of physics teachers, it is possible to work on the student-focused teaching, learning for understanding, development of curiosity, and cultivation of an independent learner (Eylon & Bagno, 1997). These communities will be a part of the constant and long-term development of the physics teacher (Berger et al., 2008; Eylon & Bagno, 2006).

2.5 The Paris Community as a Model for Regional Physics Teachers Learning Communities

During ten years of activity in the framework of a professional learning community "close to home", twelve learning communities were established. In all the communities together there are about 240 teachers, who constitute about 20% of all the physics teachers in Israel (Eylon et al., 2020). Three of the communities are intended for distance learning, and the rest of the communities meet face-to-face, scattered from the north of Israel to its south. Every community is managed by two instructors, and physics teachers of different levels of teaching experience in the high school participate in the community. Teachers choose the community that most suits them according to the proximity to their place of residence or workplace. The Paris Community that serves as a test case for this research study is situated slightly south of the center of the country. The communities are distributed at great geographic distance so that there is no reason to compete over the participants between the different communities. The teachers can barely deliberate the choice of the preferred community since they are required to come to the sessions after the work day and will prefer not to have to travel too far. The contents in the academic part of the encounter are identical in all the communities, and the difference is expressed only in the first part, which is intended for social formation, sharing and creation of a sense of belonging (Waldman & Blonder, 2020).

The Paris Community was chosen to serve as a representative model for all twelve physics teacher communities operating in Israel. Since the researcher serves as a community leader in this specific PLC, there is the opportunity to interview the teachers, observe them during the community meetings, and collect data. The name of the community and the name of the teachers mentioned in this research are pseudonyms. The conclusions drawn from the Paris Community can allow for the generalization of the learning characteristics also in other PLCs and all the population of physics teachers who learn in a regional professional community. The number of teachers in every community is different and ranges from 15 to 35 participants. The numbers are not stable, and the number of teachers changes from year to year. Although many teachers return to participate in the communities' year after year, naturally a number of teachers leave over the years and

new ones join. As a result of this situation, in every community there are teachers for whom this is the first year in the community and teachers who have experience in the community (Bagno et al., 2021).

In the Paris Community there are 32 teachers a year, on average, and it is considered one of the larger communities. The condition for the establishment of the community is a minimum number of fifteen teachers, and in certain years there were communities that did not open following the low number of participants. The large number of teachers and the great difference in professional experience between the teachers of the Paris Community enabled the diverse choice of the participants for this research study. The teachers teach in different schools, but they all teach physics. The teachers come to the Paris Community in order to improve their teaching in the framework of a professional learning community "close to home" (Scherz, 2018).

The research participants were chosen from all the teachers of the Paris Community as representing the physics teachers in the PLC program. The decision was made to focus on this group since the information about them was consistent and continuous and included answers about many documents during all the years of the research. The sample included teachers at different stages of their professional development. The different cross-section of teachers in the years of learning in the PLC provided rich qualitative data for the research study. Despite the different cross-section of the teachers, here there is an opportunity to analyze and learn the behavior of a group that has a shared culture (Shkedi, 2003). The analysis of the information will represent the diverse viewpoints of teachers at different stages of their professional growth. It constitutes an important datum in the learning characteristics of the teachers throughout their careers.

From the data of this research study we will attempt to evaluate the learning characteristics of teachers through a local look at the Paris Community and a global look at all the communities of physics teachers. Accordingly, the choice was made to carry out the research study according to the qualitative paradigm, the aim of which is to document and to attempt to understand the research participants' unique and subjective world. The Paris Community is a case study that means the documenting of a group of people

throughout the process (Stake, 1995). The social context has considerable weight and the interpretation of the qualitative data must be carried out by a researcher who knows the society and culture on which the research is performed. In this case, the researcher is a part of the researched community, a fact that necessitates the use of triangulation.

According to Shkedi (2003), the understanding of the context of the phenomenon is vital to the understanding of its reality; in other words, the researcher can obtain information and understand the environment and the reality in the interaction with the participants but without intervention in the research field.

The Paris Learning Community is a large and diverse community that simultaneously investigates in-depth the contents of the science teaching and the enrichment of the knowledge in physics (Levy et al., 2020). The aim of the learning is to shift the focus from the content the teachers are teaching and the way in which they teach and the experience they create for their students (Buabeng et al., 2018). In this way, according to Hattie (2012), they 'invite' the students into the learning and enable them to succeed, and this is the supreme goal of the PLC.

In the present research study, we will examine the place of the learning community in the personal and professional development of the teachers in the Paris Community. The deciphering and identification of the shared elements in the perceptions of the teachers of the Paris Community can enable better understanding of the needs and activity in additional communities of teachers. Since this research study addresses the perceptions and feelings of teachers, it was found that the approach of the case study is the most suitable.

The research study will be performed using naturalistic research methods employed in the qualitative research approach, namely a case study with cooperation between the researcher and the research respondents in the entire research period. Case study is the observation of human activity in a certain place and time, and this method is suitable for a follow-up research after the community of teachers in the learning process (Sabar Ben-Yehoshua & Dargish, 2001).

In the meetings of the Paris Community, the researcher serves as a participating observer; in other words, she is involved in the research field since she is a part of it. The researcher seeks to collect information about the thinking, the perceptions, and the beliefs in the research arena. In the analysis of the results, an attempt will be made to identify general patterns from which it is possible to reach the in-depth understanding of the examined phenomenon in the test case. In other words, in the analysis of the Paris Community we examine the teachers' perceptions and from the specific case we draw a broader generalization on all the physics teachers in the PLC. The research in this approach shifts the focus of interest from the difference between the teachers to the learning process they experience as a community. It is required to collect many and rich data on the test case in order to understand the researched phenomenon (Krenske, 2002). The importance of the drawing of lessons from the communities' project creates the need to assess the project. In this way, the conclusions of the case study can serve as a starting point for a more accurate look at the project of the communities.

There is wide variety in the perceptions of the different teachers in the Paris Community. Hence, they may represent all the teachers who are participating in the regional communities and thus teach us about the researched phenomenon as a whole. In the research study, processes that occurred in the Paris Community and may occur in every other community in which the teachers of physics participate are sampled. Differences of opinion between the teachers contribute to the refinement of new ideas related to the different cultures of the different community members. The conversations between the teachers create networks of interpersonal relationships that will constitute an infrastructure for learning on the social communication in the communities.

In the choice of the method of case study, there is a modest statement about our desire to research pieces of reality in the way closest to this reality. Researchers who choose this method believe that the understanding of the personal case will lead to a more in-depth understanding and construction of generalization of all the cases. The findings of the case study provide understandings beyond the specific case and help present a phenomenon or topic that occurs in one place or in a similar environment and under similar conditions. According to Stake (1995), the research literature tackles the question of whether it is

possible to derive generalizations of a case study in light of its uniqueness and the extent to which the research of single individual case enables generalization of generic problems with broader and more general implications.

The learning community is a product and summary of social and cultural processes. The case study of a specific community deciphers the actions and personal and social processes in the diverse contexts and thus enables the focus on the change of the processes over time (Krenske, 2002). The reference to the case study is from two perspectives: the look at the entire project of the communities as a whole and at the same time reference to the Paris Community as a unique phenomenon in a given social unit. The research in this approach enables taking a close look at the research arena and understanding it as social and cultural constellation. Case study enables the researched reality to be described and an inclusive framework to be provided through the finding of patterns of actions and behaviors and the emphasis of variables and meanings. The method engages in the analysis and understanding of the research participants' actions and then attempts to describe the pattern that will allow both an in-depth understanding of the examined phenomenon in the case and generalizations and descriptions that enable the understanding of broader phenomena to be reached.

The method of the case study will help interpret behaviors, cognitions, phenomena, and beliefs with focus on the understanding in-depth of processes, without the researcher's intervention (Sabar Ben-Yehoshua & Dargish, 2001). The social context is a decisive factor in the success of the research study and the interpretation of the qualitative data, and therefore the researchers are required to know the culture and society, since the researchers themselves constitute a main research instrument. In this case, the researcher has led the physics teachers for six years already and is involved in the community, and therefore the research study will be subjective. In qualitative research there is room for subjectivity, for the freedom of creation of the researcher and for flexibility in the information data so as to analyze a version of reality (Shlesky & Arieli, 2001).

This version of reality is the researcher's point of view as it formed in the sessions with the research respondents, and the researcher is entitled to bring himself and his way

of understanding into the analysis of the reality (Sabar Ben-Yehoshua & Dargish, 2001). In the present research study, which engages in the discourse on the practice, the case study has an advantage. This is the possibility of reaching a holistic understanding of the social-cultural system in action, as expressed in the discourse in the community (Krenske, 2002). The disadvantage of the case study in the present research study is that this understanding is limited to activity at a certain time and in a certain place (Stake, 1995).

According to Bolam et al. (2005), an effective community of learners is a community that operates over time and maintains norms of trust and cooperation among its members. The Paris Community was established in the second year of the operation of the communities' project. The large number of teachers in the Paris Community and mainly the number of teachers who persevere in attending, year after year, indicate its success. The research study addresses the teachers' perception of the community effectiveness. Hence, there was the correct choice of the decision to research this community as a test case. The analysis of the teachers' perceptions in a strong, stable, and successful community can help the decision makers in the field of education to use them as a test for a broader general argument.

Research studies on PLCs show that the learning community will be effective and efficient when the teachers come to the meetings that continue over time and in a gradual process assimilate the changes in their ways of teaching (Levy et al., 2020).

The Paris Community is a strong pedagogical community of physics teachers in which a heterogeneous and diverse group learns, thus enabling an overall representation of physics teachers. Year after year the Paris Community fills and the experienced teachers return to the community, alongside the novice teachers who join and find a home in the community, a greenhouse, with people who listen and provide advice from somebody a little more experienced than them. Over the years, a strong community was built that became a meaningful factor in the assistance of the new teachers and in the cross-fertilization of the expert teachers. Hence the combination of the social aspect and the professional aspect gives the teachers the motivation to continue and come to the community meetings (Eylon et al., 2020; Waldman & Blonder, 2020).

The contents conveyed in the communities require a slow and consistent assimilation. It is not simple for experienced teachers to change their approach to teaching physics. Hence, long-term and continuous attendance of the meetings is necessary to feel the effectiveness of the learning community. Only continuous attendance, every other week, month after month, year after year, will cause the innovation of the ways of teaching of the teachers following the intensive exposure to the diverse teaching methods. Hence, the Paris community is the representative test case since the experienced teachers represent the group of physics teachers that continues to develop regularly and in the long term (Berger et al., 2008).

In all the learning communities of physics teachers there are two leading teachers. In the Paris Community the shared guidance is that of the researcher and another senior teacher, who bring with them the added value of each one of them. To enable the success of the community, it is important that the instructors have experience and professional knowledge. The experience is acquired only after a number of years of guidance in the community. Hence there is also importance to the professional development in the very learning in the community of teachers who lead over time (Levy et al., 2018).

The training of the leading teacher is long term, and it is required that the person will accompany the community over time. The leaders are those who taught the community for years and experienced with it the stage of maturation and stabilization. In the case of the Paris Community, the two instructors are experienced teachers and with experience in the guidance of this community. This additional viewpoint again confirms the justification for the suitability of the Paris Community as a test case. In this research study, the community instructor is a teacher who investigates the community teachers. This is an educational research that creates the conceptualization of the researched phenomenon, shedding light on human behavior and therefore advancing the existing knowledge in education. This research study is a means for evaluation that leads to insights that embody possibilities for the improvement of the education system (Sabar Ben-Yehoshua & Dargish, 2001). From the personal aspect, the community instructor is a teacher who researches the teachers of the community and from the aspect of the community the

teachers research themselves. The teachers of the Paris Community methodically research their beliefs, perceptions, and pedagogical knowledge.

The community provides the teachers with an opportunity to actively investigate their way of teaching, perform reflection on the practice, and analyze the outcomes while learning from the fellow teachers. The biweekly meetings enable the cultivation of the teachers' collaborative, active, and meaningful learning. They provide them with continuous support on the part of their peers who are undergoing similar experience in a respectful and nonjudgmental environment (Levy et al., 2020).

If we attempt to generalize the individual case, then we will notice that the establishment of a cooperative learning system, through interpretation and reflection, may help all the physics teachers improve their professional work. The community teachers who investigate their work observe through the magnifying glass their teaching methods and contribute to the improvement of their work in the class and to the broadening of the knowledge base in the researched field. In this way of methodical reflection, the teachers have a significant contribution in the creation of knowledge and not only in the implementation of the knowledge created by the research of others. When teachers research their teaching together, they clarify their goals and their beliefs, develop new knowledge, and learn from the ideas and experience of others and thus broaden and enrich their knowledge on their students' learning (Bagno et al., 2021).

One of the guiding principles in the Paris Community is to provide a voice to the teachers and their needs. The professional learning in the communities is based on discussions and reflection out of the desire to allow the teachers to act and influence themselves on their learning. The community teachers bring evidence from their classrooms and research together their students' learning. In cooperation, they develop teaching practices that allow the advancement of their students' learning.

This fact strengthens research studies on the PLC, in which the main idea is that all the teachers of the learning community are themselves learners (Darling-Hammond et al., 2017; Martinovic & Horn-Olivito, 2020).

3. Methodological foundations of the research

3.1 Research Approach

This research study focused on the population of physics teachers who learn in a regional professional community and examined their perceptions about the learning community. The research study will be a qualitative research, so that it will be possible to understand the findings from the context in which things occur. According to Shkedi (2003), the understanding of the context of the phenomenon is vital to the understanding of its reality; in other words, the researcher can obtain information and understand the environment and the reality in the interaction with the participants but without intervention in the research field. The choice was made to observe in the researched environment using qualitative research instruments that complemented one another: observations, interviews, protocols, and texts that the participants wrote in the end assignments, at the end of the meeting and in expectations questionnaires. These instruments allowed observation of the community through different types of points of view using spoken and written language. The choice of the instruments derives from the desire to learn the behavior of groups, which have a shared culture (Shkedi, 2003), and to describe different aspects of the reality in the group, or in other words, the study of the community as a unique social unit.

3.2 Project Aims

The project aims:

- To provide insight into the opinion of teachers about the processes of change in professional development of physics teachers participating in professional Learning communities in Israel.
- To identify, describe, and explain the factors that create positive changes in the life of the community in teachers - community members' – opinion.

To achieve these aims, I need to achieve following objectives:

- To collect information from respondents about the role of a physics teachers' community

- To examine the extent to which the belonging to the community contributes to the change in the ways of teaching in respondents i.e. community members' opinion, in the context of teachers' professional development.
- To identify difficulties and problems and to identify effective ways for the inculcation of changes so as to build the professional community as a model that supports teaching, in teachers' opinion

3.3 Research Questions

The research questions at the heart of the present research study are as follows:

1. What are the perceptions of the physics teachers and what is their attitude towards the participation in professional learning communities?
2. What is the contribution of the professional community to changes in contents and ways of teaching that occur among the physics teachers?
3. What in the teacher's opinion are the causes of effectiveness of the professional physics community?
4. Did the change that occurred in the teacher following his participation in the community create a change in the students' learning?

3.4 Research Population

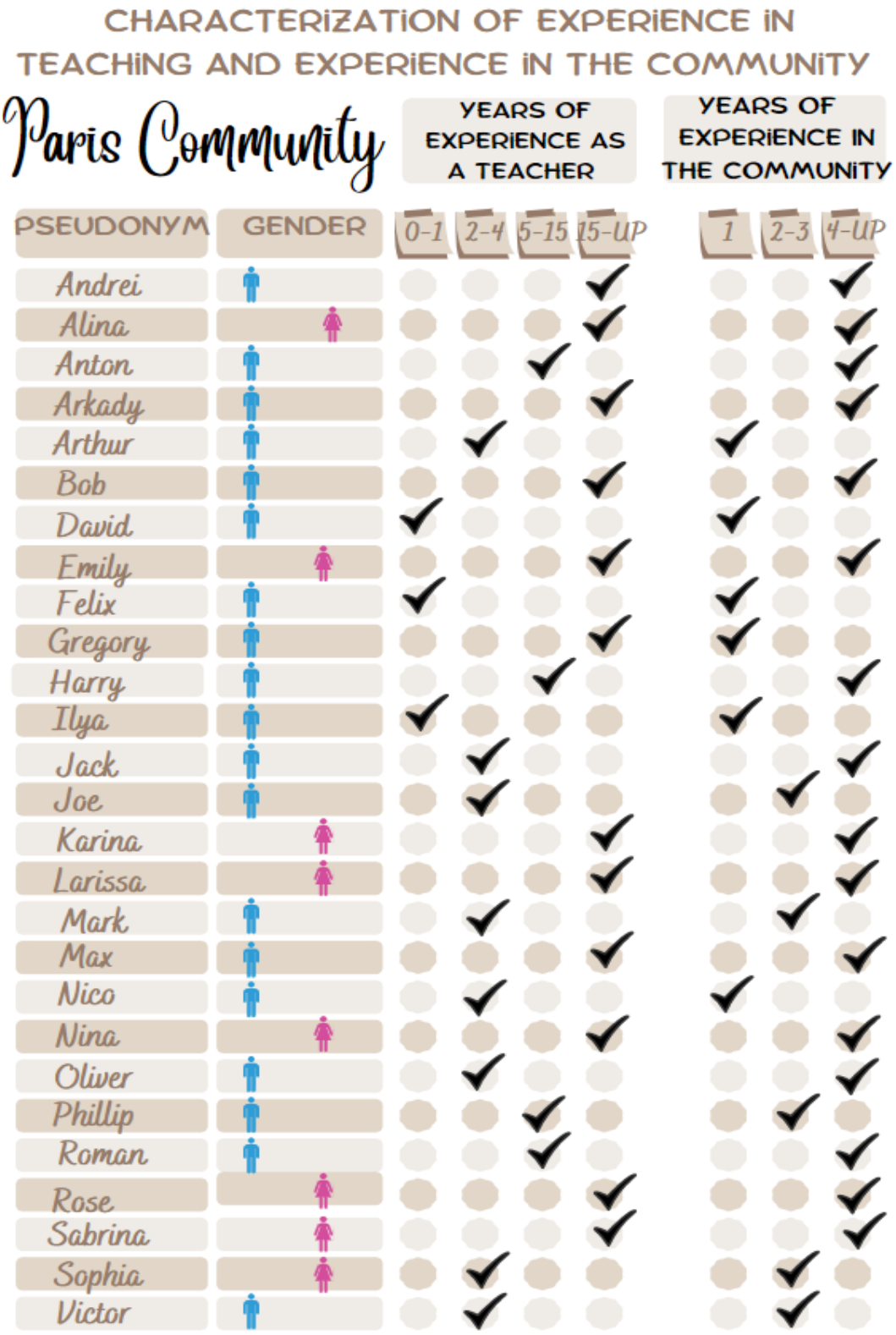
The professional community is composed of men and women physics teachers who teach in high schools. The research population is diverse and includes Twenty-six teachers upon whom the research is performed. The teachers are of different ages and have different levels of teaching experience, ranging from new teachers until teachers with considerable experience in teaching. An especially interesting group in the community is the team of older teachers, with considerable experience, who came from the Former Soviet Union, who espouse East European teaching methods, tend not to share, keep the knowledge to themselves, and are less open to innovative teaching strategies (Sever, 2004).

The research participants were chosen from all the teachers of the Paris Community as representing the physics teachers in the PLC program. The decision was made to focus

on this group since the information about them was consistent and continuous and included answers about many documents during all the years of the research.

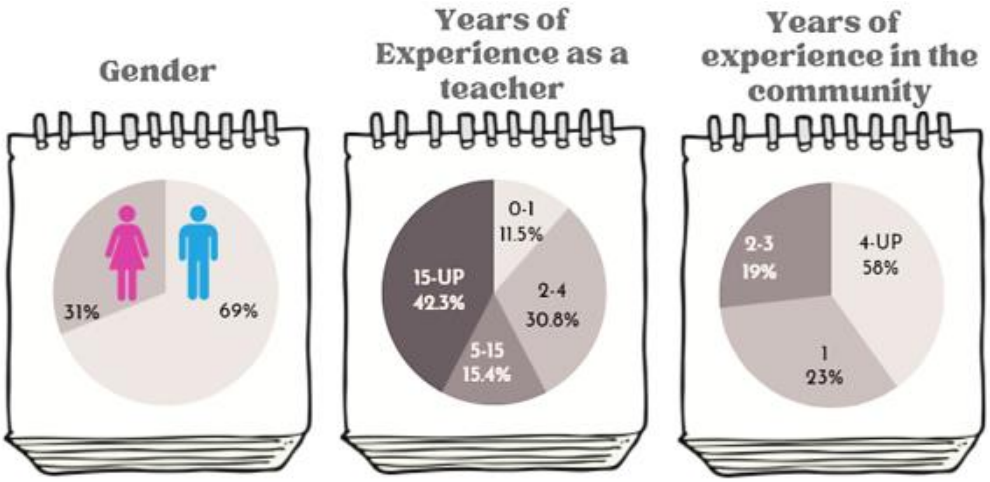
The sample included teachers at different stages of their professional development. Group 1 consisted of teachers at the start of their path in teaching and in their first years in the community. Group 2 consisted of teachers with experience in teaching but with a different distribution in their experience in the learning community. Group 3 consisted of teachers with considerable experience in teaching and again with a different distribution in their years of participation in the Paris Community. The different cross-sectioning of teachers in the years of learning in the PLC provided rich qualitative data for the research study. This information enables the diverse viewpoints of teachers at different stages of their professional growth. It constitutes an important datum in the learning characteristics of the teachers through their careers. Figure Number 2 describes the distribution of the years of experience in teaching and years of experience in the community as well as the gender.

Figure Number 2: Profile of the Teachers in the Research Group



The distribution of the research population in the table can also be presented graphically, therefore enabling the visual segmentation of the 26 research participants. Figure Number 3 describes from a statistical perspective the heterogeneity in the teachers' number of years of experience in the community and in teaching. The teachers teach in different schools but they all teach physics. The teachers come to the Paris Community in order to improve their teaching in the framework of a professional learning community "close to home" (Scherz, 2018).

Figure Number 3: Statistical Profile of the Teachers in the Research Group



The segmentation of the statistical data shows that a decisive majority of the teachers are men, 69%, versus women, 31%. This datum is not surprising at all, given the fact that this is the teaching of a scientific subject. For the teaching of physics, the teachers have a degree in the engineering professions or come from other areas of the studies of the sciences, and the gender gap begins already in the university (Silbey, 2016). A difference was not observed between the answers of the men teachers and those of the women teachers, and therefore in this research study there is no further reference to the difference in gender.

Regarding the percentages of years of experience in the community, it appears that there is a slight majority for the teachers who have participated in the PLC program for more than four years. 58% of the research participants persevere in coming to the community, year after year. This fact is commensurate with the findings on the extensive

social relationships created among the community teachers (Grossman et al., 2001). In contrast, a significant difference was not apparent between the number of new teachers and the number of experienced teachers in the Paris Community. This heterogeneity enables mutual cross-fertilization and learning from colleagues.

3.5 Data Collection

3.5.1 Research Process

To achieve the research objectives, data were collected from four cycles of activity of the Paris Community in the years 2016-2020. Since the knowledge that accumulated on the community is broad in scope, a number of focuses of observation are required. It is necessary to look both at the conceptual knowledge and the knowledge about the knowledge, namely, the investigation of the knowledge created among the teachers. In addition, it is necessary, concurrently, to have an in-depth and in-breadth look at what is happening in the community. The in-depth look is intended to identify and absorb the changes in the personal discourse and learning characteristics of certain teachers. The in-breadth look is intended to absorb the change in the group discourse, the learning characteristics, and the interactions of the entire community. The methods of data collection and analysis are aimed at the achievement of these goals. Therefore, the data collection in this research study was performed using diverse tools that include observations, interviews, and gathering of products of written knowledge.

To answer the research questions, it is necessary to follow up after the characteristics of the professional development and advancement of the teachers' disciplinary conceptual and pedagogical knowledge. Accordingly, 26 teachers were chosen, for whom the information was continuous and consistent, and they constituted the case studies discussed in this research study. A case study is the documentation of a group of people throughout a process (Stake, 1995). Therefore, this methodology was found to be suitable. The research was carried out in the Paris Community and included the sample group and the researcher, Daphne, who served simultaneously as a community leader and researcher. The use of diverse research instruments, the cross-referencing of the findings with the research literature, and the considerable information accumulated can allow for

the generalization of the learning characteristics also in other learning communities. In this research study considerable data was collected for four years, in the period 2016-2020, from texts of interviews and observations.

The collection of the data was performed in a number of ways in the natural environment of the community.

- Observations and documentation. The researcher carried out observations in all the community meetings while documenting the significant events in the meeting, including the behavior and body language. In these pages of documentation, the researcher also wrote down comments and insights.
- Interviews and personal conversations. Semi-open interviews were held with a few select teachers and personal conversations were held with all the teachers in the community. Appendix C presents the transcript of some of the interviews.
- Writing protocols. The speeches were transcribed and constituted an important basis for the discussion in the chapter of the findings. The analysis of the transcriptions served as an effective tool for the drawing of conclusions and discussion of the findings. Appendix D presents examples of the transcribed protocols.
- Feedback questionnaires. At the end of every meeting, feedback was given with open questions or closed questions about the meeting. Appendix G, H presents the examples of the feedback questionnaires.
- End task. At the end of every year of activity, the teachers were asked to provide feedback on the entire year regarding their professional outlook through the description of their personal experience in the year of activity. In this summative feedback, the teachers provided examples of the learning processes they experienced and reflection on the process. Appendix A presents an example of the end task.
- Expectations questionnaires. In the first meeting of every year of activity, the teachers filled out expectations questionnaires in which they were asked to describe what they are interested in receiving from the community. In the last meeting in every year of activity, they completed the same expectations questionnaire, from

the perspective of the entire year of activity. Appendix F presents an example of the feedback questionnaire.

- Meeting products. Answers to the sheets of activities, pictures from the meeting incorporated in this research study. Appendix I presents a collection of pictures from the life of the Paris Community.

The documentation of the activity will be without the researcher's intervention in the research field. The data will be analyzed using the qualitative research method through content analysis and the attempt to interpret what is said in the social context of body language, tone of speech, and intonation (Shlesky & Arieli, 2001).

The analysis of the data in the qualitative research is characterized as an analytical and not a statistical process, with intuitive characteristics that generalize and interpret the researched phenomenon (Gibton, 2001). The collection of the data will be performed to examine attitudes and opinions towards the community of physics teachers during the research and to analyze the different findings and cross-check all the sources of information collected (Shkedi, 2003).

3.5.2 Research Environment

The research study was carried out in the community of physics teachers "close to home". This is a large and diverse learning community that simultaneously investigates in-depth the contents of the science teaching and the enrichment of the knowledge in physics. The aim of the learning is to shift the focus from the content the teachers are teaching and the way in which they teach and the experience they create for their students (Buabeng et al., 2018). In this way, according to Hattie (2012), they 'invite' the students into the learning and enable them to succeed, and this is the supreme goal of the PLC. The information accumulated for the four years in which the biweekly community meetings were held. Throughout the entire meeting, which lasts four hours, observations were held and materials were collected on the teachers' learning characteristics. The meeting has a regular repeating structure and is composed of different parts that have other goals and diverse learning possibilities. To analyze the information collected, it is necessary to understand the meaning of each one of the parts in the research environment. The

community meetings throughout the country are held in parallel once every two weeks, on the same day, at the same hours, and according to almost the same specifications. The first half of the meeting is intended for the improvement of the teaching through diverse instruments, and the second half of the meeting is meaningful learning of a topic from the curriculum. The beginning of the meeting focuses on the diversification of the ways of teaching, in order to provide the teacher with innovative and creative instruments that they can take with them into the classroom. The methodical repetition of the same teaching instruments, in every meeting, is supposed to create belief in the teaching method and in the teaching instruments, and in the end the teacher will not be afraid to use the new instruments. The teaching materials presented in the meeting were sent to the teachers, already in the same evening, to their personal email, including work sheets in a format that can be edited and customized to their needs. Pictures from the activity in the community are also sent, photographed by the leading teachers in the same meeting. In addition to the personal email, all the teaching materials, announcements, updates, and pictures are uploaded for storage on the Google Drive of the community, so that every teacher can retrieve files from it or add new files at any time. The files are saved according to the areas of interest and are available to all the teachers who are participating or have participated in the past in this community.

Description of the Structure of the Community Meeting

At the start of every meeting, there is a conversation around the dining table. The physics teachers come to the community at the end of the work day, after they taught during the morning and afternoon. Naturally, most of them are hungry and a little tired, and they need a short break before they commence learning that requires concentration and alertness for three-four hours. The table is prepared from 15:45, and the teachers come, gradually until 16:15. The conversation around the table is fluid, alert, and very meaningful. Beyond the social formation, there are interesting things that engage mostly in the field of the professional content (Waldman & Blonder, 2020). Teachers tell of episodes that happened to them in the lesson and share professional experiences since the last meeting. Many times a new topic is brought up for discussion that had been a subject of the public discourse after the last meeting and the teachers are asked to discuss it in this meeting. Examples

include the publication of new directives, decisions made in the management rank of the school, announcements from the supervision on the teaching of physics, change in the curriculum, and so on. It is easier on a full stomach to sit everyone down and start the first half of the meeting with the regular 'time slots'. The goal of the first half is to give the teachers instruments for the diversification of the teaching and the useful materials for "tomorrow morning in class".

The first time slot is the continuation of the meeting around the dining table. It is called "Point of Light", and its goal is to "break the ice", to form the community and make a collection of teachers from different schools into a cohesive group with a shared goal. Here the teachers are invited to bring up events that they want to share with the community groups. At the start of the year, in the first meeting there are few teachers who are willing to speak, but starting with the second meeting there is high response and it is apparent that most of the teachers want to share what they have been going through in the past two weeks. Some of the teachers tell about personal experiences: the birth of the grandchild, a marriage, a joyful or sad family event, and experiences from the family. Most of the teachers tell about experiences from the class and from the lesson. Some bring up a problem they had difficulties dealing with and turn to the community for advice. Teachers at the start of their path generally bring up difficulties they experienced in the teaching of the profession and are willing to hear advice from more experienced teachers. This time slot lasts about ten minutes, and it is always the first, since its goal is to break the ice and bring people closer, so they can create a close, true, and direct system of relationships among the community members. The following time slots are more professional, and their aim is to provide the teacher with instruments and new means of demonstration, to take into the class the next morning for the purpose of the diversification of teaching.

The first professional time slot is the 'toy time slot'. This is a very favorite time slot of the teachers. Here an intriguing toy is presented that can illustrate a physics phenomenon and develop a discussion in the classroom. Teachers report that this time slot is also the students' favorite; it is enjoyable, surprising, and instructional. The teachers, like the students in the class, play, look at the toy, and predict physics behavior. They attempt to find laws and principles of action, discuss the forces that act during the play, and the

conversions of energy. They are challenged while investigating and observing to turn the toy into a scientific model that can be used to understand and explain physical phenomena. In the first meetings, the community leaders bring the toys but over time, the teachers discover the beauty of the game and bring their own games.

In the film time slot, the teachers watch a short video that deals with one of the topics relevant to the teaching program at the time. For example, in the month of October the topic of kinematics will be learned and therefore the film that will be presented will be in this domain. At the start of the year, the film was chosen by the community leaders, after many deliberations and the use of judgment. The film must be interesting but relevant and allow a professional discussion at its end. In the second trimester of the year the teachers begin to respond to the leaders' call to share materials and begin to present films of their own. They found the films on the Internet or they took the films in the classroom with the students or at home in order to illustrate a certain phenomenon. After the film, there is a discussion on the central physics topic that we saw. Teachers bring up ideas for worksheets that can accompany the film or a demonstration that can illustrate the phenomenon. The discussion also goes in-depth in the field of the physical content, refining issues that the students may have difficulties with. Sometimes in the shared work of the community teachers a guideline sheet for a film or a worksheet is developed, to enable the advancement of the learning of this specific topic.

Physics in pictures – In this time slot, the teachers are presented with a relevant physics picture related to the learned topic or to a holiday that began in the same period. The picture sparks a discussion that has the aim of promoting the topic and enhancing understanding, raising difficulties and prior opinions that sometimes are mistaken. In this time slot as well, at the start of the year the pictures are chosen by the leaders, but after a short period of time, the teachers began to present pictures that they took during a trip abroad, an interesting site they visited, or a physical phenomenon they saw. Sometimes a pretty picture is presented, for example, a rainbow after rain. Even such a routine picture can excite and awaken many research questions. Looking at a picture is another means of the diversification of the teaching and can illustrate physical phenomena and connect between the theoretical laws and reality.

From my class – In this part of the program, the stage is given to the teachers. The community members can present interesting activity they held in their class, the Internet website they operate, an attractive lesson plan they built, a demonstration they performed, and special activities that created a change in the class atmosphere. Every year, in the first meetings the same teachers are always the ones who presented. Slowly openness was created, and additional teachers began to share what is done in their classrooms. The presentation of the activity is not accompanied by criticism at all. The community leaders make certain from the first lesson to prevent the matter of judgment. This is to encourage additional teachers to participate and not to be deterred by the fear of what the other teachers will think and say about them. It takes a considerable amount of time in the life of the community until the teachers begin to share their teaching methods. It is not obvious that the teacher would want to reveal what is done in his class behind closed doors, mainly new teachers who are not confident in their professional knowledge and are afraid of making a mistake in the teaching of physics.

Physics in everyday life – Here the means of illustration that clarify routine phenomenon in the era in which the education system and the technological world set for us new challenges all the time are presented. The goal is to connect between theoretical physics and everyday life. Pictures are brought up, and demonstrations that explain and illustrate natural phenomena are presented. Simulations that enable the development of inquiry skills, and the integration of theoretical knowledge and practical experience are presented. Topics related to sports are a good example of the connection between the theoretical laws of physics and the analysis of the physical activity, and therefore many teachers like engaging in this topic, which excites the youth. Physics explanations are also presented on the manner of action of innovative devices. Students mainly like the explanations related to mobile phones and computers. It is clear that teachers listen with interest in this time slot since they are asked by their students about the theoretical part of the use of the computer or mobile phone and they do not always know the answer but they take upon themselves the responsibility to make the knowledge accessible. Physics is considered, with justification, to be the most basic science, and it constitutes the foundation and infrastructure not only for all the hard and technological sciences but also for every attempt to understand our physical life environment – from the nearest to us to the

hypothesized edge of the universe. The understanding of the principles of action of devices and the inculcation of the foundations of this science are vital for all the students since they are required to function in a technology rich environment and especially because of the need and desire for their successful integration in a society rich in the technological challenges of the 21st century.

The laboratory time slot – In this part, physics experiments that can be held in class are presented. In the first meetings, the leaders generally carry out an experiment, hold the inculcation of knowledge on the topic, and develop an in-depth discussion on the discussed physics topic. In the continuation, the leaders present an experiment, distribute equipment, and allow the teachers to experiment themselves with the assembly of the system, the construction of the electrical circuit and the optical system, and all the apparatus necessary for the acquisition of skills in the laboratory. Sometimes the community teachers initiate laboratories and demonstrations. This activity is very beneficial for the teachers, and they note it as one of the most meaningful activities for them. Sometimes a familiar experiment is presented, but generally this is a new experiment that challenges the teachers. The part in which they build, connect, and work also creates new social relationships, since the experiment is held in groups. The leading teachers make sure to assign the teachers in the group beforehand so that each time they will get to meet new community members. The workshop of the laboratory creates also recognition of the strength of the group activity. Many senior teachers avoid activity in groups since they are afraid of the chatter that accompanies the activity and prefer to teach only theoretically. The activity in the laboratory is an important value in the teaching of physics and accompanies the theoretical teaching closely and throughout the entire way. The student is supposed to understand that if the essence of the science of physics is the investigation of natural phenomena, then he must know the material reality he is studying. The physics teacher is required to interweave the laboratory work in all the topics of study (Vossen et al., 2020).

At the end of the presentation of the time slots, there is a break, followed by the active learning of some physics topic. In the break, the teachers talk freely around the table. Frequently the conversation revolves around the teaching materials they obtained. The

teachers voice their opinions about the activity, make suggestions for improvement, and sometimes mention their criticism.

The second part is the academic part whose contents are guided primarily by the Weizmann Institute (Eylon et al., 2020). The leading teachers guide the active experience in which the teachers function concurrently as learners and as teachers in classrooms. In the activity, the community teachers examine methodically together with their colleagues their teaching and their students' learning, in order to advance teaching processes that focus on the students and are tailored to their ways of thinking and difficulties. The teaching methods presented in the activity are research-based, are sensitive to the difficulties and needs of the different physics students, and encourage the students' involvement in the learning process and knowledge organization processes (Levy et al., 2018). The community teachers experiment themselves with the new teaching methods as learners and deploy them afterwards in their classrooms in an approach based on the testimonies from the classes and on collaborative reflection. When the teachers become learners, their students' achievements improve (Hattie, 2012) – and this is the supreme objective of the PLC in practice. After the experience in the class, the teachers return to the community with insights, comments, improvements, and conclusions. They bring with them to the community the students' work sheets and together they go over the common mistakes, topics that require refinement, analysis of the responses, shared difficulties, and ideas for the improvement of the teaching. This reflective way enables the teachers to go through a conceptual change in the context of the teacher's role, the teaching, and the learning. This is also the way to deepen their knowledge in physics and in the teaching of physics and to cross-fertilize one another for the diversification of the teaching and the creation of enthusiasm and attraction to the profession. All this – in the framework of a professional learning community, in a nonjudgmental and supportive familial atmosphere that enables the building of the teachers' knowledge, the assimilation of the practice, and the change of the pedagogical perception in new teaching approaches acquired in the community.

Figure Number 4: Representative Structure of a Meeting


From my class
My classroom
The Marshmallow Challenge
Physics in everyday life
Physics in everyday life
INERTIA
Physics lab time
Physics Lab
The break
Pause...
Significant learning
Significant learning in physics
Teaching based on diagnosis
1. Concept Map
2. Building a Test

3.6 Research Methods

The research study will be performed using naturalistic research methods employed in qualitative research approach, i.e. a case study with cooperation between the researcher and the research respondents in the entire research period. Case study is the documentation of the behaviors of group of people over a process (Shkedi, 2003), and this method is suitable for a follow-up research after the community of teachers in the learning process.

For the purpose of insights on the questions of this research study, a qualitative research is required, with the goal of following up after the physics teacher and documenting the given situation of the community to understand the research respondents' unique world. The method of the case study will help interpret behaviors, cognitions, phenomena, and beliefs with focus on the understanding in-depth of processes, without the researcher's intervention (Sabar Ben-Yehoshua & Dargish, 2001). The social context is a decisive factor in the success of the research study and interpretation of the qualitative data, and therefore the researcher is required to know the culture and society, since the researchers themselves constitutes a main research instrument. In this case, the researcher has led the physics teachers for six years already and is involved in the community, and therefore the research study will be subjective. To provide greater depth for the research study, the researcher will use triangulation and will cross-check data from three different independent sources. In qualitative research there is room for subjectivity, for the freedom of creation of the researcher and for flexibility in the information data so as to analyze a version of reality (Shlesky & Arieli, 2001).

This version of reality is the researcher's point of view as it formed in the sessions with the research respondents and the researcher is entitled to bring himself and his way of understanding into the analysis of the reality (Sabar Ben-Yehoshua & Dargish, 2001). In the present research study, which engages in the discourse on the practice, the case study has an advantage. This is the possibility of reaching a holistic understanding of the social-cultural system in action, as expressed in the discourse in the community (Krenske, 2002). The disadvantage of the case study in the present research study is that this understanding is limited to activity at a certain time and in a certain place (Stake, 1995).

3.7 Research Instruments

The instruments for the collection of the data will be qualitative instruments: interviews, observations and documents. The information obtained from the qualitative instruments is more limited but in greater depth and enables the achievement of profound insights about the community of physics teachers.

The interviews with the teachers in the community will be based on *a* semi-structured open interview instrument (Sabar Ben-Yehoshua & Dargish, 2001). In an open interview the questions are phrased ahead of time but the continuum of their presentation is spontaneous and is not decided ahead of time. It is possible during the interview to add and remove questions, to change questions, and to phrase differently according to the context and the answers of the research respondents. The questions that will be presented to the research respondents will be the research questions and general questions.

The open interview will be an in-depth interview, a conversation between two participants so as to understand the respondent's experience and the meaning he attributes to it. In-depth interviews will be analyzed with content analysis and classified according to categories in the comparison between the respondents and the creation of interpretation for the researched phenomenon (Gibton, 2001). In other words, from the long text of the questions and answers themes and units of information, which are formed into ideas and insights regarding the research field, are catalogued (Shkedi, 2003). It is possible to address the interview in qualitative research as a dialogue in which the researcher attempts to understand the reality from the respondent's perspective (Kvale, 2006).

The interview expresses the respondent's voice and enables him to present freely and in his own words his life and his outlooks. If the researcher succeeds in creating mutual relations of trust and closeness, the interview will become a close personal interaction between the researcher and the researched subject. While it is possible to see the interview as an encounter in which the researcher receives information from the researched subject or a meeting with the goal of creating closeness and achieving products, Kvale (2006) defines the interview as a conversation that has a goal for the purpose of obtaining information and insights from the research respondent.

An open observation sheet of the physics teachers will be performed for the purposes of follow up after the activity of the communities through the presence in all the community encounters and writing observation reports. This instrument for the collection of data through visual means suits the qualitative approach.

In the observation, the details of the research environment, behavior, events, and phenomena will be carefully recorded. In the structured observation, the researcher determines ahead of time what he is interested in observing, but this instrument is suited to qualitative research. According to Shkedi (2003), in the open interview the researcher documents all the occurrences as they are observed in real time, in the natural conditions, and does not plan ahead of time what to observe. The researcher is required to be careful that it is naturalistic inquiry and therefore he will not shape the research environment, control the data, and limit the respondents. The researcher will look at and listen to the respondents in their natural environment and will attempt to understand their interpretation of the reality while it is a part of the occurrence (Shkedi, 2003).

In the analysis of the observations, emphasis was placed on different processes that occur in the community – the analysis of the interactions that occur among the teachers and the use of innovative teaching methods and new contents. During the observation, comments were written that included items on what occurs and meaningful episodes. The different episodes that the researcher observed enabled their integration as an instrument that adds power and reliability to the teachers' behavior and statements. For the purpose of the analysis, in every meeting only the parts that were relevant to the research study were chosen for quotation and transcription.

The use of documents will include the analysis of data and the disassembly into categories of feedback written by the teachers. Many materials written by the community teachers over the four years in the end tasks, feedback, and expectations questionnaires were collected. Considerable information was also collected in the documents, including the products of the meeting, such as sheets of activities and protocols. The analysis of the documents enabled the understanding of the background and overall representative picture of a meeting of the Paris Community. For the purpose of the analysis, only parts relevant

to the research were chosen to be quoted. Throughout the research, the researcher made a list of points of reference that will allow the preservation of emotional and non-verbal aspects in addition to the written words while documenting carefully, thoroughly, and reliably. The goal of the expectations questionnaires was to learn about the teachers' perceptions of the learning community before the start of the activity and at its end. The analysis of the questionnaires was performed in a way in which the teachers' responses for every question were collected according to their relevant content and were divided into secondary categories.

In the present research study, protocols that document the end of the year events of the national community of communities were collected. In these meetings, hundreds of teachers from all the regional communities come to an experiential and enriching meeting. The speeches at the start of the meetings were transcribed painstakingly, analyzed, and constituted an important basis for discussion in the chapter of the findings. The voices of the PLC project developers, community directors, professional physics supervisors, Weizmann Institute scientists, and leading teachers were also heard. The speeches focused on the life of the community, the relevance, and the new contents learned. The analysis of the transcripts served as an effective tool for the drawing of conclusions and discussion of the findings. For the analysis, only the parts relevant to the research were chosen for quotation and transcription.

3.8 Validity and Reliability / Trustworthiness and Transferability

Since the research study is a qualitative research, the concepts of 'validity and reliability' commonly used in a quantitative research are exchanged for the concepts of 'trustworthiness' and 'transferability'. The concept of 'trustworthiness' addresses the degree to which the data, the findings, and the conclusions delineate a picture that reflects and is commensurate with the described events, while the concept of 'transferability' addresses the degree to which the findings and the conclusions enable the projection of the findings of this research study on other contexts. In addition, it is necessary to address researcher bias. There is a fear of bias in the interpretation following the researcher's positioning as the instructor of the Paris Community.

Trustworthiness. To ensure the trustworthiness of the research study, a rich database was built that includes participant observations, semi-open interviews, and different types of documents. The collection of the data was not oriented at the goals or questions of the research study; rather these are raw data reflecting the occurrences at the time of the collection. On the basis of my lengthy stay on the research sit, the collection of the data at different times and in different contexts was possible. It is necessary to note that the collection of the data was accompanied by the recording of my points of reference on episodes and non-verbal aspects in order to present a coherent picture of the phenomena observed. In addition, the collection of the data using many tools allowed me to triangulate. Hence, it is possible to address the presented picture as reliably reflecting the context in which the documented events occurred and the trustworthiness of the interpretation.

Transferability. According to Stake (1995), case study is special because of its uniqueness and not its generalizability. The aim of the present research study is to build knowledge and learn about the processes of discourse in the professional communities. Therefore, the transferability will be achieved through the presentation of the rich contextual background that enables the reader to understand the uniqueness of the researched phenomenon and to conclude about other contexts.

The transferability is achieved in two elements, the attempt to connect between the present research findings and the theories from the research literature (in order to obtain further insights on the researched phenomenon) and the attempt to connect between the present research findings and its special context (in order to emphasizes its uniqueness and singularity and to shed light on the possibilities in additional contexts).

Research bias. The researcher's position in the research field – this point touches upon the researcher's place and identity in the researched situation. In this research study, the researcher is a partner in the team of leaders in the Paris Community and serves as a researcher in this environment. She participated as a participant-observer in all the community meetings. Her positioning may influence the choice of the research question, the research methodology, and the collection and analysis of the data (Krenske, 2002).

To prevent research bias deriving from the researcher's emotional involvement in the collection and analysis of the data, comments and reflections were written alongside the observation documenting the meeting. The reflective writing enabled the processing of the experiences through the separation between facts and emotions. In addition, distance, time, and place were maintained from the stage of the collection of the data to the stage of the analysis. This enabled the analysis of the facts and less emotional involvement.

3.9 Ethics

This research study was carried out according to the rules of research ethics (Sabar Ben-Yehoshua & Dargish, 2001). The consent of all those involved in the project of the physics learning communities was obtained – the teachers in the Paris Community; the instructor of the community, Andrei; the head supervisor of the teaching of physics; the Chief Scientist's Bureau in Israel; the head of the Science Teaching Department in the Weizmann Institute of Science; and the manager of the PLC program of Physics Teachers Communities – on the basis on full information on the process of the collection of the data and its goals. The collection of the data was carried out openly and from the free will of all those involved, without the exertion of pressure or coercion of any kind and without deviation from the agreements. Each one of the involved parties received an explanation about the importance of the research study for the advancement of the teaching of physics in Israel. The teachers of the Paris Community, the research participants, signed a document in which they gave their consent to the documentation of the community meetings. Appendix B presents an example of the consent document. All the names in the research, aside from the researcher's name, Daphne, were replaced and all the means necessary were undertaken in order to assure the participants' confidentiality and privacy. The name of the community and the name of the teachers mentioned in this research are pseudonyms. These precautions made it possible to maintain research ethics in this study.

4. Findings

The objective of the research study was to understand in-depth the characteristics of the learning and the feelings of the physics teachers in a professional learning community. To examine the influence of the internal structure of the meetings on the system of relationships between the participants, to analyze the norms formed in every meeting, and to clarify how they develop. To examine the relationship between the participant, the acquisition of the contents, and the stage of learning, research questions were built that lead the analysis of the findings obtained. The research questions examine the effectiveness limits of participation in a professional learning community (PLC) of teachers and extend the impact to the teachers, students, and community leaders. There is no doubt that the participation in the community contributes to the professional development of the teachers (Borko, 2004). This chapter will present the findings on the degree of effectiveness that the teachers feel towards the division into categories. Through the findings, the factors of the effectiveness in each category, the learning characteristics, and the motive for participation in the community will be examined.

The choice was made to observe in the researched environment using research instruments that complemented one another: observations, interviews, protocols, and texts that the participants wrote in the end assignments, at the end of the meeting and in expectations questionnaires. These instruments allowed observation of the community through different types of points of view using spoken and written language. In the analysis of the findings of dozens of texts that represent different viewpoints of teachers, different methodological instruments were incorporated, leading to the identification of synergetic connections and complicated relationships between the types of the interaction the teachers developed among themselves and between them and the instructors, norms that developed, the weave of the interpersonal relations that was formed, as well as the motives for coming, learning, and collaborating.

Written feedbacks on the feelings of the teachers in the community were collected in a number of ways:

1. In the end assignments in which the teachers were asked to provide feedback on the entire year, referring to their professional perception, with description of their personal experience in the year of activity.
2. At the end of every meeting, the teachers filled out a short feedback form regarding the meeting.
3. In the first meeting, the teachers filled out the expectations questionnaire before the start of the year of activity in the community.
4. In the last meeting, they filled out the same expectations questionnaire, with the perspective of a complete year of activity.

   For example:

   First meeting: What do you expect from the participation in the community?

   Last meeting: Did the participation in the community meet your expectations?

All the end assignments, session summary feedbacks, and expectations questionnaires of the community teachers were collected in the years 2016-2020. All in all, dozens of texts that represent the viewpoints of dozens of teachers were accumulated. The materials analyzed are primarily from the teachers who participated in the communities in all these years, continuously. To maintain the respondents' anonymity, the name of the school and the city where it is located were not mentioned, and all the respondents and people who were hosted in the sessions were given pseudonyms. The phrasing of the assignment is similar in all the years and is presented in Appendix A.

To provide an answer to the main research question and relationship between the contents, the process, and the learning in the PLC, three supra-categories that are entwined were chosen. The combination of different methodological instruments in the analysis of the findings led to the identification of complex relationships between the three and raised the need to search for more inclusive dimensions that will enable the learning characteristics to be refined. These dimensions strengthened the connection between the different layers of the learning process. The variety of viewpoints, spoken language, and written language, enabled the examination of the effectiveness of the participation in the community through reflective thinking on the teaching practices and the students' learning. In-depth thinking, rich discussions, and reflection can lead to the change of the teachers'

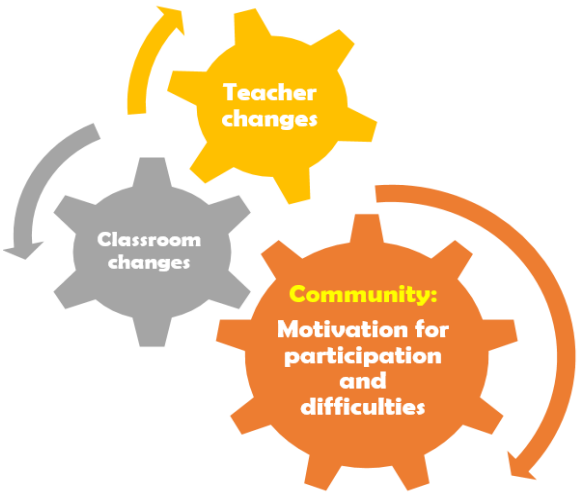
perceptions, the reconstruction of the knowledge, and the shaping of their professional identity. The change of the perception of the physics teacher will effectively penetrate into the class and the students (Bryk et al., 1999; Michelini & Sassi, 2014).

This chapter presents the findings that have the aim to examine the factors of the effectiveness of the PLC as found in the present research study. The attitudes of the teachers towards the contribution of the community to their professional development, the processes of change they experienced, and their influence on the class will be presented. Through the analysis of the stories of the teachers' professional growth, we will attempt to indicate the pattern of change that characterizes them.

It is possible to divide the findings into three supra-categories, which influence one another.

- Changes and development that occur in the teacher following the participation in the community.
- Changes that occur in the class following the teacher's participation in the community.
- The teachers' attitudes towards their participation in the community – motives and difficulties.

Figure Number 5: The Connections between the Changes and the Development that Occur in the Teacher, the Changes that Occur in the Class, and the Teachers' Attitudes Following the Participation in the Teacher Learning Community



This chapter will present all three of the intertwined supra-categories, as described in Figure Number 5, with description of every category in its different components, characteristics, and strata, as expressed in the teachers' words. The continuous professional growth in the PLC linked between the construction of the teachers' knowledge as independent and developing learners and the construction of the knowledge of the students of the community teachers who eel the change in teaching. The entwining of the categories provides a comprehensive picture, ranging from the changes in the knowledge of the teachers, through the change of the approach, to the change of the teaching methods. The change in the class depends on the change that the teacher feels, and the change in the teacher influences the change in the class (Eylon, 2013).

The activity in the PLC is intended to accustom the teachers to use learner focused teaching strategies, since the student is the final target audience. All the strategies in the program of the communities are based on research, and their aim is to develop and strengthen the student's conceptual understanding. This is performed through the advancement of the joint learning in the class that will yield in the end the students' confidence in the understanding of the challenging subject of physics. The change in the ways of teaching that the teacher adopts for herself in a long-term in-service training course in the community will penetrate into the classroom and will create a greater depth of understanding and an increase in the number of students who are interested in learning physics (Levy et al., 2018).

Learner-focused teaching is the thread that links between the teacher, the student, and the learning material, and its goal is to better the learning. The professionalization in this topic in the community will cause changes in the teaching method and will improve the teaching ability of the teacher in his class, since the teacher has a main role in the learning process. For this purpose, the teachers of the community open the door of their classroom and share with their colleagues the quality teaching materials and successful activities they developed. The teachers hold a reflective conversation on the activity, their teaching, and their students' learning. They mediate for the students the learning materials they acquired and implement in their classes the innovative teaching methods and thus seek to examine the influence of the innovations on their students' learning.

During the years of activity of the communities of physics teachers, there was an increase in the number of high school students who chose the studies of physics as their main subject, and the number is continuing to grow consistently and significantly. Teachers from the community of leading teachers reported that the number of students in their class who chose to learn physics increased following the changes that they carried out in their ways of teaching, and the teachers attributed this to their participation in the professional learning community (Levy et al., 2020).

4.1 Changes and Development that Occur in the Teacher following the Participation in the Community

This section presents the changes and development that occur in the teacher following the participation in the community.

- To evaluate the types of changes and development that occur in the teacher following the participation in the PLC, an analysis of the type of interaction was conducted by dividing it into characteristic categories. Three sub-topics were chosen: personal development, social changes, and professional development.

The detailed types of interaction enable the delineation of a comprehensive picture on the learning processes that occurred, the processes of change that occurred, the relationships between the teachers, and the difficulties that appeared and the responses to these topics.

4.1.1 Personal Changes and Development of the Teacher

The depth of the change that occurred in the teacher following her participation in the learning community is influenced both from the change of the approach to teaching and from the extension of the interpersonal relationships with the community members.

4.1.1.1 Change of Approach

There are reciprocal relationships and connections between the teachers' educational perceptions and their personal beliefs on the topics of teaching and their ways of action in the class (Kim et al., 2012). Therefore, to establish a change in the class, it is necessary to focus on the approach of the teachers to the implementation of innovations, diverse teaching methods, and learner-focused learning methods. Analysis of the teachers' documents indicates that the contents to which they were exposed in the community influenced their approach to teaching.

Harry described the change of his approach to teaching in that he feels more confident in the teaching of physics because of the materials he acquires in the community. "I feel great confidence in the teaching of physics since I am obtaining all the tools to do this in the best way. The great richness in it enriches us, the toys and the games, the films, the pictures and the presentations that awaken us to diversify, to renew, and to enrich our ways of teaching." (End Assignment, 2019). He addressed primarily the demonstration of physics topics using toys: "One of the strengths of the in-service training course is the toys. Almost all the toys we saw, already the next day I bought them and presented them to the students, each and every one in its time when this contributed to the understanding of the learning material." (End Assignment, 2016). This declaration indicates that the regular time, in which the teachers are exposed every week to a new toy that demonstrates a topic in the curriculum, indeed was accepted and the teachers adopt the method and change, if only a little, the traditional approach to the lesson. The regular ritual, in which in every session a toy is presented that serves for the demonstration of a physics law or exercise, always results in positive responses. The toy goes from hand to hand, and in the break many teachers attempt to implement it, and photograph the product or the packaging, so that they can purchase it themselves and discuss the possibilities of using it. In each one of the communities all around the country,

the toy is presented at the start of the session, with an explanation of its integration in teaching. On the issue of the change of the approach in teaching, Mark also described the change he experienced in this way: "The community gives a platform that exposes different approaches of teaching and analysis of educational events in making the material accessible." Regarding the deliberations, he wrote, "I am happy that I can share with the community members the deliberations and illuminations that I have had during the year." (End Assignment, 2019). Two years beforehand Mark wrote: "From the desire to know the world of teaching, found recently in dynamic processes of change, I find great importance in continuous communication with the community of physics teachers." He noted: "An opportunity is given to involve the community teachers in new challenges that arise for the teacher personally and that he seeks to solve, thus enabling the teacher different viewpoints through different teachers, through the sharing of their rich experience." Mark compared his teaching to the period before he joined the community: "In comparison to my first period of activity in the profession, I felt that my involvement in the community has transformed me into a more professional and goal-oriented teacher." (End Assignment, 2017). Mark frequently describes in a positive manner the new approach to teaching that he has adopted for himself following the in-service training and feels that he will continue to develop and advance. It is clear from his statements that during all the years of participation in the community he changed his approach to teaching and felt that he himself is developing professionally and becoming a better teacher.

Joe, a novice teacher, who is not required to change an approach but to shape an approach, described also: "I am aware of my lack of experience in teaching in general and in physics in particular, and I check all the time what needs to be done." He noted: "Teaching physics is itself a topic that needs to be reinforced all the time, and I am still not on stable ground. I search all the time for different ways to explain to the students the physics phenomena or principles (each student understands differently) – this is challenging and develops me." Moreover: "Since I am a novice teacher, every new experiment that Andrei presents, every video, or every professional dilemma is an asset for me and true learning, so I really anticipate the community meetings … in the community there is the sharing of knowledge and experiences that enrich me and create thoughts what can be strengthened, what can be retained." (End Assignment, 2019). It is possible to prominently feel in his statements the rise in his professional self-confidence.

The community is composed of expert teachers and novice teachers who contribute to one another, each in her or his own way. Joe, a novice teacher who feels that he has not mastered the teaching of physics sufficiently but who is very proficient in technology, advises the expert teachers in topics related to Internet websites and digital platforms. He shares with the community teachers the techno-pedagogical tools that he has created, explains how to operate them, and greatly helps the expert teachers who have less mastered this domain and attempt to avoid it. Expert teachers are afraid of dealing with unfamiliar technological tools, but Joe, with great patience, attempts to change their skeptical approach to the matter. It is possible to see that the change of the approach is carried out both among expert teachers and among novice teachers and the integration between them allows everyone to learn from one another.

Karina, who is an expert teacher, maintains that the community has many advantages. "I enjoy both the company of the professional colleagues, expert and novice, and the review of topics and ideas that I also know in terms of the learning content, it is always enjoyable to see a new approach / a teaching idea different from what I know." In addition, Karina changed her approach to teaching. "The community has become part of my teaching! I frequently use the ideas learned and the teaching methods, show the films, research with the students and use diverse teaching methods." (End Assignment, 2017). The change of approach that Karina felt gives her the ability to renew and refresh in different activities and to diversify her teaching methods. She sees an advantage in the participation in the community, which causes her to examine methodically along with her colleagues their teaching and their students' learning. The community created a regular and continuous framework for relationships between the teachers, and it is possible to receive help, advice, and cross-fertilization. The continuing learning creates slow but consistent assimilation of the new approaches until they become an inseparable part of the teacher. As Karina noted, the community became a part of her teaching; in other words, a part of what she sees as the image of the teacher who develops and re-examines, all the time, for years, her teaching.

Another teacher noted: "Following the community, I invest far more thought how to improve my lesson plans, integrate means of illustration and multimedia that will make the lesson more interesting and relevant to the students. I am certain that the community greatly helps me

improve my teaching methods." He added: "I am certain that as a result of my membership in the community I brought to my school new ideas, new experiments, and new learning methods that, without a shadow of a doubt, improved the quality of my teaching and that of other physics teachers in our staff in the school." (Jack, End Assignment, 2017). Jack felt the change of approach in the teaching that caused him self-discovery of his abilities as a teacher, to go out of his way and invest in order to produce an attractive and relevant lesson that will inspire the curiosity of his students.

Research studies show that since the start of the activity of the professional communities of the physics teachers, the number of high school students who chose to study physics has significantly increased and continues to increase consistently. In other words, the participation in the PLC created in the physics teachers a change in the approach, which caused a change in the classes, and as evidence, the number of physics students increased, and the teaching ways changed, along with the strategies, approaches, and atmosphere in the group (Levy et al., 2020).

It is possible to summarize this part, therefore, that in terms of the change of approach in teaching the satisfaction with the participation in the community was prominent among many teachers. The community meetings were a positive experience that increased their self-confidence.

4.1.1.2 Extension of the Interpersonal Relationships with the Community Members

Many teachers emphasized that the community meetings enabled them to get to know other teachers, which created cross-fertilization and the possibility of information exchange. They noted the interaction with other teachers as an important component that added to them self-confidence and a feeling of partnership in the way. It is possible to see in the observations of the meetings that pairs and small groups were created, in which the social relationships extend beyond the community meetings and new friendships are forged. An example is the statement of Nina, an expert teacher, an active participant in all the discussions and professional conversations in the community. She comes to the community, a distance of 40 minutes of travel in every direction, with professional colleagues she got to know in her first year in the community. Her statements indicate that

the lengthy shared travel and the social encounter in the community broadened the circle of her colleagues and an in-depth relationship was created with a number of teachers from the community, beyond the hours of activity. "Because of the biweekly community meetings I strengthened my social relationships and we have a social circle in which we (4 physics teachers from the community) meet also after the professional activities to spend time together on vacations" (End Assignment, 2019). It is possible to see that the social relationship was strengthened in comparison to her words two years earlier: "I find in the Paris Community the supportive staff of colleagues who are with me their unique activity – they convey to me, at my request, teaching materials and aid materials – and meet with me in the framework of the vacations as friends for spending time together." She notes that: "Because I am a leading teacher without my school staff I see the teachers and instructors of the community – work colleagues. We keep current with one another and seek advice with one another – towards the writing of semester exams and yearly planning of the studies. The teachers with experience contribute to the new teachers." (End Assignment, 2017). Karina said in the Summary Meeting (2020) that she wants to thank the friends. She did not say teachers; she did not say community teachers; she said friends. She noted that in the planner she did not write the dates of the meetings as in-service training but as a meeting of friends. "Thanks to all the friends, this was a meeting that I enjoyed and in general in my planner I do not call this in-service training but call it a meeting of friends. Truly this is relationships on another level. This made our community and our teachers and our partnership on a completely different level." At the end of her words, she added to explain about the unmediated relationship she felt with the community members that enables her to turn confidently to each one of the teachers and to hear their opinion, ask for a test, seek advice. "There is no problem calling each one of them, to ask for advice or ask for a test since our level of relationships truly became from a community of teachers to friends."

The personal system of relationships broadened following Nina's participation in the community. Karina also felt that the joint learning created closeness and with it new friendships for the professional life and personal life.

Harry, an expert teacher, notes that he feels close relations to the community teachers. "The unmediated meeting with the 'colleagues' contributed greatly both in brainstorming and in 'venting' but more than everything in the feeling and sense that we are not alone and we are all coping in some way or another with the same difficulties, the same challenges, the same

expectations, and in general we are not alone." He continued to describe about the extension of the circle of peers. "Me, the community enriched in many new things, both from the staff of instructors and from the friends, each one talented in his field, each one in his talent, each one in his special and unique style. The special mosaic of the staff with the friends created a feeling of like a family and not only a community." (End Assignment, 2016).

In the interview with Rose, in the answer to the first question about her perceptions on the community, she told that for all of her life she has been a lone wolf and she does not have colleagues in the school but she found a response in the community. Her connection with a number of teachers until they became good friends did not happen in the first meeting or the second one. This is a process that took time, and as the years pass, the community meetings become social meetings and not only professional ones. She feels anticipation to go, to renew, and to meet with people whose company she enjoyed. In geographic terms, she lives far away and can choose to participate in a community closer to her area of residence, but she chooses to be in the Paris Community since beyond the professionalism "I was privileged to get to know friends and this is no less important in my opinion" (Interview with Rose, answer to question 1). The combination of the social aspect and the professional aspect gives her the motivation to continue and to come to the meetings. Rose shared personal experiences, including that there are days when not everything goes smoothly and there are days with ups and downs in professional terms. In her words, sharing personal problems with good friends in the community and with the other physics teachers causes you to understand that you are not alone. Her professional troubles as a teacher of physics are shared by all, she is not exceptional. In addition, the support group of the friends encourages her that she is not alone, that they are all in the same situation and are a little saturated with the teaching. This shared fate instills in her new life.

Oliver, a relatively new teacher, also addressed another aspect of the broadening of the interpersonal relationships with the community members. "My third year in the community of physics teachers. I came with high expectations following the two successful communities of the previous two years, and I am happy to say that also this year (thanks to the leading staff … the participating teachers … and also the refreshment …). I found the community to be a very enjoyable meeting place." (End Assignment, 2016). Oliver describes the enjoyment

of the meetings both from the instructors and from his fellow teachers of physics. In his first year, he connected particularly to Arkady, with whom he found a common language and shared humor. Over the years in the community he created more and more friendships, and it was possible to see when dividing into work in groups that he created around him a group of teachers who enjoy learning together and are always with one another.

Roman, an expert teacher, addressed the interpersonal relationships with his peers in the community and noted that his participation in the community advanced him and helped him in two different ways. "On the level of pedagogical skills, teaching methods, and contents in physics" as well as the social facet: "Extension of the circle of professional peers". He described that as a single teacher in the school he sometimes feels "a type of 'loneliness' when I deliberated and desired to seek advice on a certain topic, such as – the order of teaching, level of difficulty, means of demonstration, and so on. The community gave an appropriate response to this problem." He emphasized the extension of the interpersonal relationships. "I not only got to know many additional fellow teachers but also developed relationships that enabled me to be helped and to seek advice also outside of the framework of the meetings themselves, so that I did not necessarily have to wait two weeks until the next meeting if I have any question come up." (End Assignment, 2017).

The teachers' statements indicate that one of the greatest changes that they derive from their arrival to the community is the very encounter with the colleagues who have become friends, although ostensibly this is not the stated goal of a PLC of teachers.

4.1.2 Social Changes of the Teacher

To learn about the influence of the change that the participation in the community creates in the social topic, we focused on a number of aspects: interactions of respect and esteem between the teachers, cross-fertilization, work in groups, and cooperation, and belonging to the group creating knowledge. The vision of the community in social terms is to strengthen the openness, the cross-fertilization, and the interaction between the leading teachers and their community, between the teachers of the community and their colleagues, and between the teacher and her students. All this is done with the goal of causing the community to be a place of openness and trust, a place where the participants feel confident

to be exposed, to dare, to help one another, and to learn. If we examine the vision of the community from the professional aspect that engages also in the challenges of physics, then one of its objectives is to promote the implementation of the student-focused teaching strategies. The combination of the social and professional vision proves that the community is a place that enables the teachers to examine through the cooperation with their colleagues their students' learning and their own ways of teaching.

4.1.2.1 Interaction, Respect, and Esteem among the Teachers

From the analysis of the observations and the interviews, it appears that the teachers all emphasize the social aspect. The teachers noted that the community enables the exchanges of information and that the interaction with teachers from other schools is an important component that added to them confidence, feeling of mutual responsibility, and partnership in the way. In the feedbacks of the end of the first meeting that the teachers wrote it is possible to see examples of the esteem that the teachers hold for one another regardless of their professional experience in teaching. Max, although he has been a teacher for more than forty years, noted, "In the community I hear many important things. It is interesting to hear different teachers and opinions of methods in the learning of physics." Harry also noted that the interaction with the teachers in the community is meaningful for him. "The meeting with all the colleagues from the other schools is very important for me." On the edge of the scale, Mark, who is a new teacher, noted that he is happy to receive advice: "It is nice to meet and to receive reinforcement from other teachers."

One of the goals of the physics teachers when they come to learn in the community is the utmost realization of their students' scientific potential. This potential is composed primarily of the students' analytical ability but is also influenced by the emotions they feel towards physics and towards the study of physics. Hence, improvement in the teacher's teaching methods will create interest towards the learning of physics and thus the potential innate in every student will be fulfilled. One of the components of the teaching ways is expressed in solving problems and difficulties that the teachers experience during the lesson. The sharing of the problems in the community enables them to be jointly examined by all the teachers of the community, while feedback is provided and a possible solution is

discussed. It is necessary to remember that for the teachers to agree to share their problems and professional deliberations, great trust is required in the learning community. For the teachers to examine with their colleague's daily problems in teaching, in a critical and advancing way, they are required to know that they have something to learn from their colleagues' experience and interpretation of these problems. An example can be seen in the end assignment of Oliver. "I found the community to be a very enjoyable place – both for the purpose of the exchange of opinions / impressions / knowledge in a non-formal framework and for the acquisition of ideas for the improvement of the teaching itself (videos, demonstrations, etc.)." He added that "I found great interest in the conversations in the corridor in the breaks of the community meetings, since this was a way to communication with fellow and experienced teachers on issues related to the school, the class, and the system as a whole." In addition, he noted, "The insight that certain class phenomena are the province of all the teachers (including the experienced teachers) helps in each teacher's personal coping in his class. Specifically, the meetings had considerable importance because of the opportunity to conduct conversations in the hallways with the colleagues." He ended with the statement, "From these respects my participation in the community meetings was a very successful experience that I enjoyed returning to every two weeks."

Learning from the other teachers in the community requires a delicate balance since teachers with considerable self-confidence in their abilities to succeed always and in every situation will not feel the need to change their ways of teaching and may not listen in order to learn from other teachers. Therefore, professional learning in the community, learning that has the power to improve the teaching, requires the teacher's recognition of the fact that her teaching can and needs to improve. In other words, professional improvement requires the teachers to recognize the boundaries of their capability. In an interview with Emily, she noted in response to the first question that she comes to the community knowing clearly that she does not have anything to renew or to learn and she did not understand what she could obtain from the meetings. "I was an expert teacher and already more or less I knew everything." After a number of years in the community, she understood that the concept of the community in which teachers share their knowledge contributes also to her despite her considerable experience. "In activity on the force of friction, I was certain that I already know everything about the force of friction, but I heard one teacher who explains in one

way and another teacher who defines in another way and this focused for me all sorts of special points that were not completely clear." She added that from a personal perspective she learned from the other teacher's new things. If we remember that she is a teacher with considerable experience relative to the other teachers of the community, this is proof that it is possible to acquire knowledge from the colleagues regardless of their experience or expertise in teaching.

It is possible to feel the esteem and respect that the teachers hold for one another in the words they wrote in the end assignment. Victor, a teacher who is finishing his first year in teaching, wrote: "I found an open and vibrant community when all the teachers come with a spark in their eye, love for their work, and desire to contribute and to improve. The desire to help one another and to learn from one another, if his experience is less than yours makes the community into an involving team that is pleasant to work with." He sharpened the contribution from his fellow teachers as well as from the community instructors and the leading teachers: "The main advantage from my perspective is the nature of the teachers in the community, the desire to learn and contribute from your experience and opinions to the community. Another important advantage is the experience and nature of the guidance of the instructors, I greatly enjoyed learning from the proposals of the way of learning, the means of illustration and teaching, and so on."

The teachers enjoy the company of one another, which is a blessing in itself. Karina wrote after the first meeting in 2016: "I loved going back and meeting. We met old and new professional colleagues." And a year later, at the end of the first meeting: "I missed people." In addition to the enjoyment that the teachers derive from the interaction with other students, the by-products are beneficial to them for further teaching, such as tests, worksheets and ideas for lesson diversification. Andrei shed light on another point and noted that the teachers come to the meeting with a rather diverse and rather large group of people and in essence they can find an answer to every question that they have since there is always somebody to turn to and somebody to provide advice (Interview with Andrei, answer to question 3).

4.1.2.2 Cross-Fertilization, Work in Groups, and Cooperation between the Teachers

Research studies show that the learning community will be effective when the teachers come to meetings that continue over time and in a gradual process assimilate the changes in their ways of teaching (Levy et al., 2020). To advance the teachers' learning, the community meetings need to be challenging, focused both on the teachers' practice and on the final objective, the success of the students' learning. To encourage teachers to attempt to carry out changes in their way of teaching, it is necessary to cause them to believe in their colleagues' successes and in cooperation among all the community teachers. In the meetings, an attempt was made to cause cross-fertilization, joint work, and cooperation using learning based on authentic evidence that the teachers bring from their classes. In this process, a teacher brings findings from her class and all the teachers of the community together examine the students' works and draw conclusions. Karina wrote in her end assignment about the advantages of cooperation and cross-fertilization. "I am greatly helped by the materials conveyed in the community for the purpose of the diversification of the teaching and from the cross-fertilization undertaken in it. I use films that Andrei is showering on us and nice experiments to highlight different laws of physics. I am happy to be updated with the ideas of all the in-service trainees and also after [20] years in the field I feel that there always are new ideas and I am happy to learn." It is possible to find in Anton's statements confirmation of her statements and understanding that the power that the community has is far stronger than the power of one teacher. "The in-service training course is the combination of 'teachers' room for physics' and professional and pedagogical sharing of ideas for physics teachers". He describes the contents that he acquired and the contribution he feels from the side conversations that are held around the dining table, in the hallway, and during the breaks. "In the framework of the in-service training, emphasis is placed on inquiry activities in the class and on the diversification of the teaching methods. For me, the contribution is even more essential. Alongside the pedagogical activity occurring in the meetings, which exposes us to new and innovative ways of learning, I feel even more rewarded by the side conversations between one activity and another. These conversations synchronize me, give me an indication of the pace of learning, awaken my attention to certain topics in the curriculum appropriate for emphasis and different thinking, and in general cause me to **feel a part of the community with a shared goal**. This simple thing is a true **power multiplier**, which greatly strengthens the feeling of satisfaction with the profession."

Figure Number 6: The Picture Anton Chose for the End Assignment, to Emphasize the Idea that the Community is a Power Multiplier

The shared learning in the academic part provides an opportunity for the teachers to research actively their teaching, to reflect consistently their professional advancement and the implications on the students' learning in the class. From the instructors' perspective, the division into the work groups in the academic part is undertaken intentionally in order to create a mix between expert teachers and novice teachers. It is apparent in the End Assignment (2017) that the teachers wrote that the experience in teaching does not have importance in terms of the desire to learn from one another.

On the one side of the scale, Victor, a teacher in his first year, wrote that the participation in the community constituted an important addition to his first year of teaching. "Throughout the whole year I met with teachers, who like me appreciate their work and come to it with a spark in their eye (I understand today how rare this is and just this is worth the participation in the community.) I received continuous instruction from expert teachers and **we shared** the successful teaching methods, ways of illustrating the material in physics and making it accessible. The students were happy about the additions to the teaching ways and would anticipate them every lesson." From his perspective as a novice teacher, the innovative strategies he acquired in the community shed light directly on their ways of teaching. Expert teachers also wrote that the meeting with other teachers empowered their professional confidence and caused them self-discovery.

On the other side of the scale, Alina, a very experienced teacher, was surprised to discover that the others see her to be an authority in the professional field and felt an

increase in the fulfillment of her personal potential. She said that as a single teacher in the school for many years she does not have anyone with whom to share and to share knowledge, and so she is happy that the community gives her the opportunity to teach teachers. She patiently answered all the teachers who turned to her with questions and sought her advice, and it seems that she took upon herself the role of mentor for the novice teachers in the community. In her opinion, the inculcation of the knowledge she has acquired during the 30 years of teaching to the novice teachers is of great importance: "the older generation produces the new generation." As a direct continuation, she also was open to learn from novice teachers, to hear their opinions, to enjoy their company, and to be helped by them. "In recent years, I come to the community meetings not only for learning but also for social meetings. It makes me happy to see that there are a number of novice teachers from whom I am happy to learn."

From the heights of her age and the many years of experience she has gained, she still wants to stay in the company of colleagues and learn together: "Every meeting in the community is first of all a social meeting that draws people closer, encourages [you] that you are not alone in the coping with the difficulties, the community greatly supports and praises."

In the middle of the scale, teachers who have taught for a number of years and are not defined as novice teachers, also anticipate the community meetings, mutual production, and cooperation. An example was written by Jack in the End Assignment (2017): "The atmosphere between all the group members is an atmosphere of cooperation, mutual assistance, and praise, which is very rare in Israeli society in general and among school teachers in particular." Jack also is a single teacher in his school, like most of the physics teachers in Israel, who feels like a lone wolf, and the community is for him a place to meet professional colleagues for the purpose of cross-fertilization.

4.1.2.3 Belonging to the Group Creates Knowledge

Teachers wrote that participation in the community created pride in the unit. The feeling is that this group can contribute, help, develop, and advance every teacher in the community. The teachers bring testimonies from their students on the activity, and then student-focused evidence-based learning is carried out. This learning addresses the

students' responses and thus cultivates not only the teaching methods but also the learning of physics itself. In other words, the interpretation of the students' answers to the questions in physics strengthens the knowledge in physics and not only the knowledge about the teaching of physics. The examination of the evidence begins among the leading teachers, who carry out exactly the same activity under the academic umbrella of the Weizmann Institute. In this way, the leading teachers acquire scientific knowledge in physics that is based on scientists and researchers, and they instill this accurate knowledge among the community teachers in identical activity. The results show that in student-focused evidence-based learning there is the cultivation of the learning of physics, and a rich range of other aspects in the knowledge of teachers and the community was discovered to be a meaningful learning environment, enriching and supportive (Levy et al., 2020).

The teachers do not conceal their pride that, by their very coming to the community, they immediately belong to a unique group that creates knowledge. For example, in the end assignment, Harry said: "I feel that in my participation in the community I am a part of a quality group of teachers of physics from the entire region." (2019) The feeling of pride does not differentiate between novice teachers and expert teachers, according to Sabrina, a very experienced teacher. "I like to meet with colleagues and see new and non-routine things. There is always something to learn." (2018) Karina noted that she greatly enjoys the community and added, "I feel that I am enriching the toolkit at my disposal and am being helped by the leading staff. **I feel that we have strength in being a group and not being alone in the campaign."**

It is possible to see the development of pride and the recognition that you belong to a group of knowledge in the differences in the teacher's responses during the years of activity in the community. If we examine Anton's answers at the end of the first meeting, it appears that in the year 2017 he still did not feel a part of the group and looked from the side. "A community full of warm and smart people." At the end of the last meeting in the year 2017, he is already more open in his answers. He clarifies that in his high school he is a single teacher. "Here I met new colleagues and my experience was enriched." He continues to come to the community since in addition to the opportunity to meet colleagues, it is also possible "to exchange ideas and be exposed to new things." The wording of "exchange ideas" means that Anton too contributes to the community. In other words, at first he felt that the

other teachers are smart and only accepted their statements and at the end of the year he feels he is one among equals and contributes his ideas. When he was asked whether he derived benefit from his belonging to the community, he answered that he is regularly assisted by his colleagues. "Seeking advice about the order of the teaching. Learning from the experience of others teachers, building tests, handling mistakes, knowing the initiatives of other teachers." It is possible to understand that he feels an active part of a group that creates knowledge. "Brainstorming about different topics, we discuss the preferred order of the teaching, share examples, ways of work, and every deliberation that arises and every deliberation that arises and there is no one to ask."

Anton was in another community until he came to us, and as a teacher who experienced different communities, he said in a meeting in the year 2018 that it is amazing in his opinion to see how in all the communities all the physics teachers speak the same language. It is clear from his statements that he appreciates his being a part of a group that creates knowledge and enjoys the company of the teachers. "Although sometimes we have differences of opinion and every teacher here has a different opinion, we all together advance to the same goal and in the same direction." We can see further progress if we look at his responses in the year 2019, when he already felt he was an important part of a group of knowledge creators. "**The most meaningful** thing that I received from my participation in the community of the teachers is the **community facet**. The possibility of sharing experiences, exchanging information between the teachers from the different schools and in general getting to know the partners on the way was for me a regular support and possibility to advance in my abilities as a teacher of physics. Also in the summary of the annual activity I shared with the rest of my fellow teachers in the community that the time I waited for during the meeting was the assembly and recess! Beyond the refreshments, the conversations with the rest of the teachers were for me the perfect teachers' room for the development of ideas and the change of experiences. Of course the topics of the conversation were not random and were greatly connected to activities performed in the in-service training itself." The look into the End Assignment 2020 again proves the strength of the community as a group creating knowledge. "In the schools the physics teaching staff is rather limited, thus limiting the ability to leverage the profession in the school. A larger group of teachers can organize broad activities of exposure and empowerment." He returns from his school to the community and projects on the students' learning in his class. "The meeting

with different teachers and the teaching strategies focused on the different learning chapters helped me greatly and improve my teaching experience and my students' learning experience."

Figure Number 7: Development of the Feeling of Belonging to the Group of Teachers Creating Knowledge

Pride in the unit can be found also in the statements of new teachers in the end assignment (2019), for example, Mark who finds the community to be a productive meeting place for the exchange of opinions and improvement of the teaching in the framework of the requirements of the Ministry of Education. "I enjoyed communicating with fellow teachers with experience who were included during the community meetings. These guests enriched me as a teacher. In addition, I greatly enjoyed the discussions conducted around the physics problems held in the community." Joe, a novice teacher, also felt the uniqueness in the participation in the community and describes the benefit from staying with a group of teachers that creates knowledge: "The community is very meaningful for me. I think that I benefited from more than a few meetings: the improvement of the knowledge and understanding of the material itself, receiving different and diverse ideas for teaching – films, experiments, demonstrations, discussions on the question, self-photography, competitions, and so on." Another novice teacher, Victor, in his first year of teaching anticipated productive meetings with colleagues and expects to

continue also in the future. "In addition to the teaching methods, the meeting was also a regular place of counseling and solving professional dilemmas, on problematic topics in the material, on topics of tests and grades, and so on. I waited every two weeks for the next meeting, and I wait for the beginning of the meetings in the next school year." Even very experienced teachers, like Roman, feel pride in the unit and need the solid support that the meeting with **esteemed peers** provides. Roman, a single teacher in his school, wrote in the End Assignment (2019) that he got to know in the community meetings new colleagues and continued to meet with additional colleagues whom he had encountered in the previous years of activity in the community. "I was very happy for the opportunity to exchange opinions / ideas / deliberate together with such a great variety of **professional colleagues, of quality and experience**. The atmosphere was very informal, and the feeling is that of cooperation and mutual assistance. I would be happy to participate in the community meetings in the coming year."

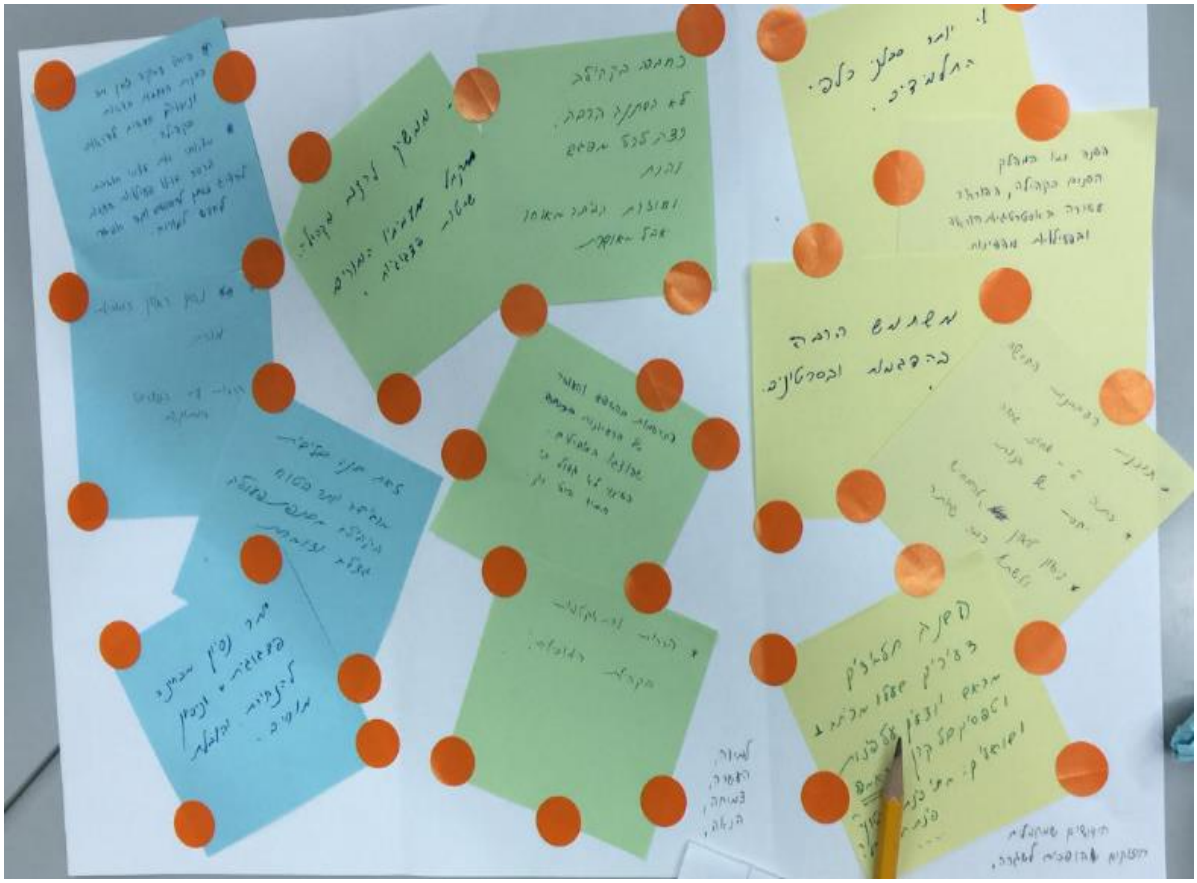
The professional community of teachers of physics has a defined identity through a shared field of knowledge, teaching skills shared for the field of knowledge and commitment towards the field of knowledge. Hence, the members of the physics learning community belong to the group creating knowledge that engages in shared activities, with mutual assistance, discussions, and knowledge sharing. They are proud to learn from one another, appreciate their peers, the community members, as creators of knowledge and thus build a respectful, accommodating, and empowering system of relationships. This system of relationships enables them to learn from one another to and produce shared tools of norms and skills that support the level of knowledge and expertise of the other teachers in the community.

4.1.3 Changes and Professional Development of the Teachers

The analysis of the feedback indicates that all the teachers find the participation in the community to be an experience that advances them professionally. Many teachers maintained that the community meetings influenced them in terms of the professional change in areas such as renewal, feeling of progress, growth, motivation, looking ahead, exposure to another world, a different viewpoint. Another aspect that arose in terms of the professional development is the diversification of the teaching methods, exposure to teaching methods, acquisition of skills, guidance abilities, broadening of the knowledge,

learning, restructuring of the professional knowledge, and implementation of contents. The contribution to changes and professional development is expressed in different topics, and from them the categories were derived. In an activity carried out at the start of the seventh meeting of the Paris Community (2018), the teachers were asked to write on sticky notes what in their opinion is the change in them during this school year after nearly a whole year of activity in the community. The teachers' answers can be classified into three areas according to colors: professional development – yellow notes, personal development – green notes, feelings towards the presentation of the lesson – blue notes. The teachers' answers appear in the following figure and after it the translation and analysis of the picture.

Figure Number 8: Answers of Teachers to the Question: What Changed in Me This Year? January 16, 2018



Yellow Notes – Innovations that Are Reinforced and Become Routine

- *[I] am more tolerant of the students*
- *This year, like the years in the community, the teaching is rich in teaching strategies and activities at the different times*
- *[I] use many demonstrations and films*
- *New testing program, in tenth grade there is a relatively high percentage of girls, an attempt to diversify, illustrate, and share as much as possible*
- *This year young students who have reached the tenth grade ahead of time know about the times and ask when it is video time? What is it picture time?*

Green Notes – Learning, Enrichment, Growth, and Enjoyment

- *As a member in a community, not much has changed, I run to every meeting, I enjoy it, and I return home late, but I am happy*
- *The impression from the abundance and richness of the ideas that were presented. The change is not great, since it was always like this.*
- *Getting to know one another and acclimation in the community*
- *Continue to enjoy the community. I receive from my teacher colleagues pedagogical methods*.

Blue Notes – 'Example Lesson' – Feelings towards Presenting before the Teachers

- *I was busy for a long time in the building of new demonstrations and new experiments to show in the community*
- *I found myself thinking a lot, which new activities can be presented and what is possible to innovate for the teachers*
- *This is the third year, I feel more confident in the community, I cooperate, grow, and blossom.*
- *[I feel] more experienced pedagogically*

The teachers' statements in the yellow notes emphasize that the PLC project achieves its objectives. A teacher who notes that he has become more patient with his students indicates in essence that he has changed his approach to teaching, internalized

advice for a successful lesson, and started to learn differently. It is possible that he has listened to the advice of his colleagues, teachers of the community, or to the inclusion strategy that the community instructors conveyed in the academic part (such as waiting time). The source of the change is not important; the process that occurred is important.

Another teacher emphasized that he is exposed to learner focused teaching strategies and activities, in each and every year. This is not a new teacher in the community, since he noted explicitly "like during the years in the community".

The next teacher also noted the tools he acquired in the community but emphasized that he uses them considerably, or in other words, implements in actuality in the classroom the theory he acquired in the community.

Another teacher addressed the change that occurred this year in the curriculum. This is a change that was deployed by the Ministry of Education and is not associated with the PLC. He noted that the number of girls in his class increased. This is a very encouraging datum, since the increase of the number of girls in physics and gender based teaching are one of the topics that the community addresses each and every year. Such an increase represents success on the part of the managers of the community's project. It appears that there is a change in the way in which he teaches and attempts to diversity the teaching methods. He wrote the words, "an attempt to share as much as possible" and in the discussion explained that he referred to the sharing of his materials with his colleagues, the teachers of the community.

The teacher who wrote in the last note caused the instructors to feel a tremendous sense of satisfaction, since his words show the extent to which the changes were enrooted in the teachers. The strategies of diversification through a physics film or picture penetrate into the students' awareness and are conveyed from one age cohort to the next. **New students who come to the high school and do not at all know the teacher already know beforehand to expect a film and a picture**. This is significant proof that the **changes penetrate into the class** and even are transferred by word of mouth among the students.

The green notes expressed the teachers' feelings of enrichment. Despite the load and the late hour in which they return home after the meeting, there is great enjoyment in the coming to the community. An expert teacher wrote that the change that occurred in her is not great since in all the years of the community she has been exposed to a plethora of ideas. A novice teacher in the community noted that he has acclimated and gotten to know his peers. The teacher who wrote in the last line also noted that he continues to enjoy, or in other words, he is not a new teacher and he continues to learn from his colleagues.

The blue notes addressed a special time, "From My Class", in which every week another teacher presents an interesting part of the lesson he held. The participation is not mandatory, but the teachers are very happy to take part in this time slot. For the presentation to be successful, the teachers prepare a slideshow, a demonstration, or worksheets. The teachers' feelings indicate that they plan the presentation of the lesson meticulously and attempt to create demonstrations and new activities that will be attractive and will be new for their colleagues.

One teacher noted that after three years of the community she no longer is emotional about presenting the lesson. She feels confident in standing in front of an audience made up entirely of her colleagues in the profession and noted that she continues to grow and develop. In the last line, a teacher who has already been presented to teachers indicates that he now feels more pedagogically confident. There is something pressuring in opening the classroom door and allowing other teachers to observe your lesson. However, it seems that the community teachers open the doors to their classes since they do not feel their colleagues are strangers.

4.1.3.1 Diversification of Teaching Ways, Renewal, Growth, Growth, Exposure to Methods

The fundamental assumption of researchers is that the teachers' professional development occurs throughout their career along with the fact that they acquire experience in teaching. Alongside this fundamental assumption, it is necessary to strengthen and support the development of teacher knowledge and skills and change in the ways of teaching. The change of the teacher's manner of teaching is a complex, continuous, and

gradual process (Eylon & Bagno, 2006), since it is necessary to carry out changes in a number of areas continuously:

1. A change in the teaching practice in the classroom is required.
2. A change in the teacher's attitudes and beliefs about teaching is required.
3. It is necessary for the teacher to see a change in his students' learning outcomes.

The leading teachers succeeded in advancing the professional development of teachers in the regional communities. The change is expressed in the advancement of the students' learning and the assimilation of the new ideas in the teaching of physics in the classes of teachers of the regional communities (Levy et al., 2020). The activity of the teachers in the professional communities contributed to change in their traditional teaching practices, to diversification of the teaching methods, and to a feeling of growth and renewal. Almost all the teachers in the Paris Community noted in the feedbacks that the biweekly meetings, month after month, year after year, caused the innovation in their teaching ways following the intensive exposure to diverse teaching methods. We follow up after the development of Emily, an experienced teacher during the years of activity in the community. She wrote about the technological change she carried out: "The camera that is connected to the computer and projector, with which our instructors in the community work is new to me. It is a wonderful method, for demonstrations, it makes the watching of a large number of students easy and enables me really to write on the board. Immediately I adopted this camera, and my professional life has improved amazingly." It is possible to understand from her statements about the camera since that despite her expertise and great experience she adopts innovative technology that she sees in the meetings. The expert teachers generally find it difficult to get along with new and innovative technologies.

In the continuation, she said: "Without a doubt, the activity that helped me more than anything was the activity we held on the topic of capacitors. The theoretical material and solving questions **certainly were known to me beforehand**, but the presentation with the relevant focuses was very helpful for me. Tables for activity on capacitors were helpful in my classes, for the summarization of the topic. Of course, the experiment that Andrei held for us to illustrate the charging of a 'regular' capacitor in the laboratory that each one has was fascinating and important. I repeated this demonstration in my laboratory, I learned, and I taught my students … (End Assignment, 2017)."

Although the meeting engaged in the known and familiar topic, it had innovations and focuses and relevant demonstration for the improvement of the understanding of the topic by the students also from the practical perspective. This is a very experienced teacher, who is willing to make a change in the usual ways of teaching and adopt new methods and technologies. Expert teachers generally do not have this desire, and it is comfortable for them to remain in the comfort zone, in the familiar and known place and not to enter into new challenges and adventures.

In the end assignment, a year later (End Assignment, 2018) it is possible to see that she continues to diversify the ways of teaching. "The community of teacher is wonderful, since they 'understand' me there. They give tools and tips for my every day. The films, the toys, the points of light, amuse and enrich my ways of teaching." She notes affirmatively all the regular time slots – film time, toy time, points of light. It appears that the regular repetition of the same ritual in every meeting makes the adjustment to it easier. The rationale in which all the meetings always open with the regular time slots indeed is helpful to establish new habits. A description of the new teaching methods to which she was exposed and with which she diversified the teaching in her class is presented here. "We learned the development of the continuum of teaching, and I implemented this in a battery. I learned a thought-provoking lab, and I applied it in the laboratory. I learned and implemented teaching methods like P.O.E., we analyzed and discussed topics that were neglected in recent years. I learned a formula analysis strategy and this helps me in the preparation lessons for the test or in the summary of a topic." It appears that regular and continuous exposure to innovative teaching methods indeed succeeds in awakening teachers from the permanence and old and familiar habits, and they bring a new and fresh spirit to the classroom. In the continuation of her words, she describes the places in which she reveals the considerable diversification she acquired on Tuesdays in the community. "Despite my experience and expertise, I enjoyed hearing and seeing new things that belong to the teaching of physics in slightly different ways. I received a database of films and ideas for demonstrations and toys that I use both in the 'serious' teaching of the students of the program and in the lectures, or presenting ideas to the General [High School] Teachers Forum, to my friends and family. The students I teach received a refreshing variety, and they were disappointed on Wednesdays in the morning when there wasn't a meeting on the good Tuesday."

The teaching instruments and innovative techniques served Emily for teaching students in the class but also for lectures before all the high school teachers and friends and family. To use the learning contents outside of the class and for teaching, the teacher must be full of enthusiasm and the desire to share knowledge with others. Her statements indicate that she adopts the contents of the in-service training and makes use of them also in places that are not connected to the class and to the students. It also appears that the students know about her participation in the community on Tuesdays and wait for something new and refreshing every Wednesday. Emily presents in her words the dual benefit she receives. There is internal reward from the very activity and satisfaction in the improvement of the students' understanding that they are the target audience for all this learning. In addition, there is external reward that comes from the high school principal, the family, and the friends following the revelation of the learning products to the audience, which is not the target audience but enjoys and praises her for it.

She continues to describe the process of the renewal. "I loved to hear ideas of other teachers in the community about the way in which they convey certain topics … in the Paris Community of teachers there was an interesting, not stressful in-service training, and it benefits me in all possible respects." Her statements clearly show that she enjoys the learning, the variety, and the professional growth. The following quote shows that she expresses reservations from innovative technological activity that appears to deter her and therefore was not yet implemented. "A number of meetings were dedicated to the idea in which the teachers film themselves during the lesson, and learn afterwards from watching the lesson, with the goal of bettering the teaching. This idea is revolutionary in the sense of 'invasion of privacy'. The lesson and the direct hit on the point of 'the teacher's loneliness'. And you must admit the truth, these revolutionary ideas will require time to become accustomed …" (End Assignment, 2018)

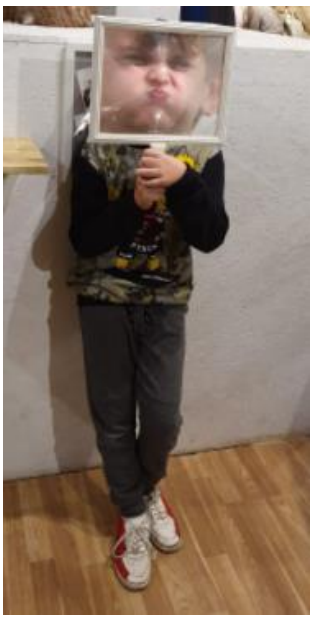
This is the first declaration in which it is seen that she cannot implement a teaching method she learned in the community. It is possible that the exposure of a filmed lesson to another teacher causes her to be afraid and in this stage she decided to give up on the method. As a sole physics teacher in her school, she is accustomed to isolated work behind closed doors and without exposure to criticism. The activity in the community of analysis of a picture contradicts the feeling of isolation and forces her to open the classroom door.

She needs to reveal herself as a teacher to the students during the lesson, to the critical inquiry of her fellow teachers.

In the End Assignment, a year later (End Assignment, 2019), it was clear that she still had not lost her enthusiasm for learning new teaching methods. "A teacher in the community presented a wonderful activity for opening a topic in optics with small mirrors, and this was most exciting. I saw how the teachers in the community and I were excited, and I chose to 'take' this to my class in the tenth grade. I brought from the chemistry laboratory small vials and glass sticks, we filled with water, and we saw while learning the laws of refraction in the movement of light between transparent environments. In addition, I analyzed in the class this wonderful picture that was presented in the community (a type of lens/positioning of the object)."

Emily added to the end assignment the following picture. It was presented in one of the community meetings, in the "picture time", and Emily used it to teach the topic of lenses. In the picture, the child holds a magnifying glass and therefore his face is not proportional to the size of the body. This is a wonderful example of the diversification of the ways of teaching, so that both the teacher and the children in the class enjoy and learn simultaneously.

Figure Number 9: The Lens in the Child's Hands Changes the Proportions of the Photograph



Nina is another expert teacher who wrote about the diversification of her teaching methods as a result of participation in the community. "In the community I like to hear new ideas and diverse ways of teaching. I enjoy learning 'tips' for interesting lessons, enrichment, and diversification of the teaching. The conversation in the community contributes to the improvement of my level of teaching, to a broader reference to the different learners and the difficulties that exist among the students, and to identifying them! I feel in the community that I am reviving the enthusiasm that I had from the teaching as in the first years when I was a teacher. Only that now my experience contributes to a far higher level of teaching than at the start of the way!" (Feedback on the First Meeting, 2017)

It is clear from her words that she is enthusiastic about the exposure to innovative teaching methods and implements them in her class. She feels that the knowledge she has acquired in the different methods enables her to tailor the teaching method to suit each one of her students.

The enthusiasm also had not waned a year later (2018), when in the community a video-didactics workshop was held. This is a teaching technique that incorporates filming a lesson in the class by the teacher and then analysis of the lesson in the forum of all the community members. At first Nina did not cooperate; only after a number of meetings did she understand the benefit in the analysis of the filmed lesson. She wrote: "I tried the process as a student and the memory was not pleasant. Therefore, in my opinion objections arose in me in the creation of a similar situation [in the community] but to my great surprise after I watched my colleagues filming themselves in the lesson, I saw the added value of the process in which I carry out self-reflection on my teaching. I found it interesting to analyze the lesson of my fellow colleagues in the in-service training and I enjoyed seeing the lessons that each one held on the same topic in various and interesting ways. I learned from them additional ways to teach the topic, and I also enjoyed contributing new viewpoints for them." (End Assignment, 2018)

It is possible to see that Nina has succeeded in overcoming the barrier of the exposure in filming the lesson and has learned to appreciate the teaching method, as opposed to Emily who remained skeptical until the end of the workshop. It appears that not every technique of diversification can penetrate into the teaching in actuality. Sometimes teachers cannot acquire new habits since the change is rather great and they do not allow the barrier of intrusion into the privacy of the lesson to be breached.

Two years later (2019), Nina wrote that in the community meetings she "is filled with energy, with motivation, and with new ideas." She noted also that: "I do not stop learning and in the framework of my participation in leading in-service training sessions, continuously, I continue to enrich and update my teaching ways. I am a member in the community of teachers for five years now. The membership in the community enriches [my] professional knowledge." (End Assignment, 2019)

Nina's statements reinforce the research studies in which a professional community is described as a space in which the teacher feels safe to share the teaching practices and professional dilemmas. The community enables reflective investigation of the teaching for the purpose of the advancement of shared values, change of habits, and creation of enthusiasm, desire, and feeling of identity from the teaching of physics (Etkina et al., 2017).

4.1.3.2 Exposure to Another World

Teachers wrote that the exposure to the contents presented in the community gives them the ability to develop, to refresh themselves, and to know a new world of activities that enrich the teaching and are commensurate with the curriculum. There is the simultaneous development of the content world and the culture of the community. The teachers improve the knowledge in physics and in teaching physics through the creation of a culture of learning and shared deliberation. Mark emphasized that sometimes teachers present a physics challenge in the form of a toy, idea, or daily situation that is raised for the purpose of a physics solution in the analysis of the event. "This activity allows the teachers to leave the world of ongoing theory directed by the Ministry of Education and enter into the world of practical reality that occurs around us." (End Assignment, 2017).

It is possible to feel this also in the words voiced by Max, a very experienced teacher who writes about the teachers' needs to be exposed to another world in order to diversify the teaching. "The education system is found in a constant process of development and improvement and the learning methods also are changing and renewing. For the teachers to be all the time current and accurate, they need to participate in in-service training courses on a regular basis. I have participated for two years in the community, and in my opinion all the teachers need to attend in-service training courses and to learn new things. In the community we acquire various learning methods with which it is possible to cause students to think and to understand. Not only

physics, but also life processes … one of the advantages in the community is the deepening of the ability to transform the professional field the teachers address into a new and unfamiliar field."

The exposure of the teachers to another word can cause a change in the personal domain, the building of professional knowledge, and a change of the teacher's perceptions, approaches, and attitudes. A change can occur also in the practical field, which will cause a change of the teacher's professional experience. Teachers sometimes do not pay attention to the change since over time they adopt another new method and another technological instrument, and slowly the change is built without them being able to indicate the moment of the start and what happened during the process. If we take an example from the other side of the experience in teaching, then we can read in the feedback of the End Assignment (2017) the words of Joe, a new teacher, about the exposure to new worlds. "In the meeting we were exposed to many and inexpensive demonstrations of physics phenomena that are not necessarily in the curriculum. The phenomena are amazing and attract students. Very beneficial summaries were presented. We experimented with toys for the purpose of practical learning and this is mandatory taking into account the benefit it provides. Sabrina presented her website on the Internet … allowed all the members of the community to enter and download materials from her website that contains many contents."

A new teacher who receives material from an expert teacher he trusts is given the time to engage in pedagogy and improve the teaching. He does not have to engage in the learning materials, and this significantly made the work program he builds easier. In the same feedback, David, a new teacher, also addressed the demonstrations and exposure to another world on Sabrina's website. "A meeting that provokes thought and is also surprising, what it is possible to do with simple products. The presentation of pages of support and the summary awakens the desire to adopt the idea." On the issue of the exposure to another world, Sophia, a new teacher, noted in another feedback (2017), that the most prominent thing in the community meeting is the exposure to different possibilities of teaching in a wide range of study topics in physics. She noted also that the instructors and community members present and participate in experiments, competitions, teaching strategies, explanations, and questions. "Ways of work that help find the most interesting and suitable way for you and for your students to learn physics. The openness and sharing is a very significant advantage for me in this framework of the community of teachers."

Even an expert teacher needs a learning experience in order to refresh his way of teaching and exposure to another content world enriches and varies his practice. An example is seen in the statements of Roman, an expert teacher. “My participation in the community advanced me and helped me on the level of the pedagogical skills, teaching methods, and contents in physics. I felt that I am enriching my knowledge, am exposed to new things, and almost after every meeting I came with something new to the classroom. A dynamics was created in the class that on Wednesdays, after the in-service training on Tuesday, the students would ask me, ‘so, what did they show you yesterday in the in-service training? and there really was expectation on their part to see what we had learned.” (End Assignment, 2017)

Arkady, a very experienced teacher, two years before retirement, tells everyone in conversations at the dining table that he does not come in order to learn but out of the social need. Nevertheless, his statements indicate that beyond conversations with colleagues he acquires both a new content world, in which he is exposed to information and stimulus, and mainly support: “In the community of teachers they speak about physics and our difficulties in teaching the profession. They attempt to correct incorrect things that we repeated because of habits and attempt to know different ways to explain concepts. Each one comes with a new idea and in the end we have gained another look at the same old topic, which we would explain in a drier manner.” (End Assignment, 2018).

If we summarize the topic of the exposure to another world, then we see that the teachers improve the personal and practical field and the external field in which the teacher is exposed from an external source to new information, support, stimulus, and curiosity. The external change is different from the personal and practical change in that it is outside of the teacher’s personal world. The personal and practical change is an internal change that includes the teacher’s world of professional practice. It includes her professional actions as a teacher, her interpretation of the results of the actions she performed, and the perceptions and knowledge that motivated her to undertake these actions (Levy et al., 2020). All the changes bring the teacher to the view and understanding of the world in a new way.

4.1.3.3 Feeling of Progress, Aspiration for More

The reading of the feedbacks indicates that many felt that the contents in the community built the professional backbone for their learning process as teachers of another type, teachers who are more attentive to the students and aware of the difficulties in the teaching of physics. The change for the better created in them the desire to continue and to learn, to continue and to advance with an investigative look to the professional future, to the realization of the potential, and to the personal development. The process in which teachers grow professionally is continuous and complicated. When they operate as active learners in the community of teachers, who carry out collaborative reflection during their practice, they will advance their development and professional growth (Clarke & Hollingsworth, 2002). The reflective discourse on the teaching itself already improves the teaching. At the end of the opening meeting of the Paris Community (2016), one of the novice teachers said that he felt that the professional discussions bring his knowledge to the surface and he is open to learning. In other words, in the community the learners' own knowledge is brought up and constitutes a basis of new learning. Even an expert teacher like Phillip noted in the feedback conversation (2019) that: "I was exposed to different methods, some of which I began already to implement and some of which I will implement in the coming school year. Every year I am exposed to new ideas (most of them I implement) in the framework of the meaningful learning and as time passes, I feel more confident in the method." In this quote the motif of habit recurs. As the teachers attempt and practice more and more, they are less afraid to open to the change. A feeling of personal progress is created, which leads to a desire and aspiration for more, for further progress. Karina also noted that she assimilated the contents that she acquired in the in-service training as a part of her way of teaching. She wrote in the End Assignment (2017) that her enjoyment in the community meeting with the addition of the richness she receives in contents and diversification influences her students. "As we enjoy more, are enriched in the knowledge and learning contents and have possibilities of demonstration and diverse teaching, our students obtain a better teacher, more advanced teaching methods, a broader range of means of teaching, and accordingly more interesting and fascinating teaching, and with it comes the success." She attributes her students' success in that she became a better teacher, because of the professional progress she made. The interest in physics she created in her students caused them to succeed in the studies of

the subject: "As we will cause interest among our students, their curiosity will increase and they will learn more happily and will succeed more. I am looking forward to next year and I am confident in my instructors – Andrei and Daphne – that they will be able to interest and innovate for me this time as well." She ends with a feeling of confidence that the inventory of strategies and means of teaching of the community instructors will not be depleted and she can continue to develop professionally also next year. In the protocol of the Conference of Communities (2020) she notes that from the perspective of her age and years of experience, she does not stop progressing and learning: "You always learn something new, it doesn't matter how many years I am in the system (25 years! God help us). Every time we learn another thing, every time you see another thing."

In contrast, Sophia, a novice teacher, admitted in the Feedback Conversation (2017) that it is still hard for her to implement the contents but she intends to change the ways of teaching. She noted that this is her first year in the community of teachers. "It is hard for me to say that my ways of teaching have changed during the year, following the visits in the community." She added an explanation for the lack of success in the implementation of the contents to which she was exposed. "In the marathon of the year, in the pursuit after the attempt to finish the material and cause the students to learn appropriately I did not stop and change the character of my teaching, the methods and the materials that I used." The continuation was far more optimistic, and she hypothesizes that the change is expected to come, in her opinion, next year. She notes the feeling of progress, the learning from her peers, and the fact that not all the materials she received suit her. "I learned much from my peers in the community and when I will plan for next year I will attempt to implement some of the things I saw fit to take from the community. These things require planning ahead of time and therefore are hard to implement during the ongoing work in the classroom. The main thing that I will want to introduce into my teaching next year is [the creation of] interest for the students. I will attempt to use more diverse teaching ways, to have many experiments, interactive lessons, computerized assignments, inquiry questions, and so on. I will put forth effort to diversify the frontal teaching that I have persevered with very nicely until now." The honesty in Sophia's statements enables a look at the life of the beginning teacher in physics. In addition to the coping with the challenging contents, the teaching difficulties, and the time pressure, there is also the desire to prove herself as an appropriate teacher. She describes the range of tools she acquired and courageously admits that she will try, if she succeeds, to integrate them in her second year

in teaching. This is further proof of the fact that the teacher who finishes his studies for a teaching certificate must continue to develop and be accompanied by a professional learning community, for the purpose of support, growth, and progress. The feeling of progress does not have to be only in pedagogical knowledge. Nina felt administrative, bureaucratic progress. The very participation in the community creates a connection between the teachers and the general supervisor of the teaching of physics. He supports the project of the communities and is careful to come to at least one meeting in every community during the year of activity. When he came to the Paris Community, he participated in a meeting, worked in a laboratory and academic activity alongside the teachers, and talked with them at length, mainly in the break. He held a vote and asked to hear opinions on the topic of the high school matriculation examinations. The counseling created among the community teachers a strong feeling that they rely on their voice and their judgment and they have considerable importance in the making of decisions of the general supervisor on physics. Nina felt the power of the community as an esteemed group that influences the curriculum and noted this in the End Assignment (2019): "I am a partner in the framework of the community for the decisions of the main supervisor on physics on professional issues – this way I feel more meaningful in my work because of the ability to influence, and in this I update my students on the supervisor's decisions." She continued to describe the administration progress she felt: "The membership in the community enriches the professional knowledge enables me to update myself quickly and continuously in all the innovations and changes of the supervision of the subject." The aim of the meetings with the guest lecturer, a general supervisor of physics or students who present projects, is to expose the community teachers to new information on the different aspects in the teacher's work and a more general view of the teaching of physics by people in the field, neutral, who do not know the teacher in the community.

4.1.3.4 Acquisition of Skills

Physics is a scientific subject in which the students are required to master complex knowledge, skills, and high order thinking for the purpose of literacy and scientific inquiry (Buanbeng et al., 2018). Physics teachers need to feel capable of creating such a learning environment for their students, and for this purpose the teaching of physics needs a change

in paradigm. It is necessary to shift the focus from practice, memorization, rules, and formulas to pedagogical development that supports inquiry learning and creation of conceptual understanding and analytical skills among the students (Timperley et al., 2007). The teachers are required to inculcate knowledge in the understanding of concepts, actions, and the relationship between them, but also in the implementation of proper, accurate, and effective procedure and the inculcation of strategic ability for the analysis and physical representation of problems and the logical inference for arguments and proofs. All this is intended for the teacher to create in the class a positive attitude towards the learning of the subject: everyone can, physics is not only for geniuses! For the teachers to meet this task, they themselves are required to acquire skills and knowledge in professional development programs as in the example of the learning community of teachers. The teachers of the Paris Community praised in the feedback the activities in which they were exposed to new contents and acquired new skills for the creation of a conceptual understanding for the students. They defined the skills they acquired as another stage in their professional development and provided examples of skills they learned in the community and implemented in the classroom. Larissa, an expert teacher, described in the End Feedback (2017) the different skills she acquired in the community for the purpose of the investigation of her teaching and her students' learning: "In our regular meetings the teachers use diverse learning strategies (such as, for example, analysis of pictures of worksheets or video passages from lessons, presentation of current research knowledge, and presentation of problems from the field). Through them they learn professional knowledge and examine the relationship between their ways of teaching and the students' learning."

Novice teachers also noted that the acquisition of the new skills to which they were exposed in the community contributed to the improvement of the learning experience and the creation of interest. An example can be found in Jack's statements in the End Assignment (2017). "We learned this year in the community: the formation of a work plan, new learning methods such as POE, new experiments, and the improvement of existing experiments, professional knowledge, and the focus of controversial professional topics, use of videos, multimedia means, and toys for the improvement of the learning experience, preparation of 'inquiry' works for students that cause interest in the learning material, new means for the

laboratory were presented that helped me in the acquisition of cheap and relevant means, the integration of social and thinking games in the learning."

The first part in the community meetings was intended to create closeness between the teachers and to give them tools for the class, tomorrow in the morning. The range of tools was intended for the improvement of the teaching, the acquisition of skills, the familiarity with the strategies for the organization of the knowledge, and the creation of interest for the students. The tools that the teachers indicated that are most useful were taken from the 'video time' and 'toy time'. The integration of video into teaching requires the acquisition of media integration skills as a means of establishing understanding. During the video, it is possible to ask the students questions, to build a worksheet based on the video or to observe the video as a basis for an illustrating and inspiring task that makes the student act. In the community, considerable emphasis was placed on the learning of video integrating skills for the illustration of concepts and processes in physics. Oliver connected greatly to this strategy, which is presented regularly in the community and is used in videos to explain physics laws and phenomena that it is difficult to illustrate in the classroom. He wrote in the End Feedback (2016): "The video that was presented in the community and I showed to my students when learning the chapter of gravitation explains how people cry in weightlessness in space … the video served as an explanation of the principle of 'weightlessness' of astronauts in a spaceship – a topic that many students find difficult and that teachers find it difficult to explain." Oliver clarifies in this example the possibility of presenting a topic that the teachers find it difficult to teach only theoretically and when they integrate visual illustration this makes the teaching easier. "The use of simulations and videos helps to improve the understanding and intuition. It is interesting that the 'new' intuition for the most part does not last over time, and it is necessary to repeat it again and again since these are concepts that are not intuitive for the regular person." Although the students see the laws of physics in action, in videos and in simulations, their previous knowledge, with which they came to the high school, dominates in most cases over the learned knowledge. The problem of the mistaken perceptions is known to the physics teachers, and in the first years of activity of the communities' great emphasis is placed on it. The skill of integrating videos into teaching does not necessitate an essential change in the planning of the teacher's lesson but only the early choice of the video film appropriate for the specific lesson. At the end of every

meeting in the Paris Community, a link is sent to the videos to be used already tomorrow in the morning in the classroom.

Karina, an expert teacher, explained in the End Assignment (2017) how she acquired another skill of the integration of a toy in the lesson in order to emphasize a physics principle, an engineering law, or a natural phenomenon. The teachers of the Paris Community watch the illustration and tend to shift the toy from one to another, to stretch, to contract, to wander, and to research. A discussion develops where it is good to integrate it in the teaching, as the start of the topic or as a summary. The rationale of the teaching of physics through toys is the connection to the subject by individuals who are close to the students' world. "Every week there was a 'toy time'. In it we saw a physics toy." It is possible to understand from her statements that the regular ritual erodes old work habits and enables the teachers to practice meeting after meeting the new skills. She added, "Sometimes we also deliberate strongly about the physics behind the toy. The in-service training participants themselves also brought toys and shared them with the entire community." The use of toys contributes to the experiential learning in the integration of innovation, relevance, excitement, and curiosity. Every week a new toy is presented. Frequently, as Karina noted, the teachers are the ones who bring and present it. The pictures present a cup with a candle, which Emily brought, and above it birds on a hoop. When the candle is light, a current of hot air is created, which rotates the birds like a carousel. The teachers discussed and researched this toy extensively. They spoke about the impact of the air currents, what would happen if the heat would come from above? What would happen if the toy is placed on a slope? When will the layout angle be greatest? They flipped the cup, placed it at an angle, blew above it, and the physics discourse on the topic of circular movement was meaningful and contributed to the professional knowledge of all.

Figure Number 10: Integration of Toys in the Teaching of Physics, Hot Air Turbine in Circular Movement

4.1.3.5 Extension of Knowledge, Learning, New Construction of Professional Knowledge

In the PLC framework, the teachers learn together how to disassemble a lengthy and complicated topic into short and clear passages, how to teach in an experiential manner, and how to use the new professional knowledge to create better understanding in the student. The professional discourse and the joint work in the academic part of the meeting build a culture of sharing and broadening knowledge through the reconstruction of learning norms. The teachers are required to be precise in concepts, to explain through the use of physics laws, to listen to one another with attention before providing criticism, to focus conclusions, and to hold a respectful argument in the case of lack of agreement. All these norms form in a spiral manner until the restructuring of the professional knowledge. The community teachers build during the year of activity their knowledge on the learning content and the pedagogy. Consequently, they also rebuild their reflective attitudes towards their practice (Eylon et al., 2020). The community teachers are aware of the need for learning for the purpose of expanding knowledge, and it is possible to see an example in the summary feedback (2016) of Oliver, who notes that he came to the PLC immediately at the start of his way in teaching. "This is the third year that I am engaging in teaching and my third year in the communities." He adds about the teachers' need to continue to learn. "Above all, it appears to me that the paramount teaching instrument is professionalism and the mastery of

the learning material, and therefore every teacher needs to continue to work in an in-depth and continuous manner."

In the academic activity of the PLC, there is no dichotomous division between the acceptance of existing knowledge and the creation of new knowledge. There is an attempt to place the teacher at the focus of the experience in the building of knowledge that is new for him and not necessarily new for the world of scientific research. The teacher actively engages in personal learning of the creation of his knowledge while accompanying the learning with a conceptual and critical discussion of the existing knowledge that he attempts to improve. Harry builds his knowledge and the quality of the teaching, every year more and more. An example of his statements is in the feedback (2016): "As usual, I greatly enjoy the meetings and benefit from the community. The meetings are very important to the quality and diversity of the teaching ways." He described how the broadening of his knowledge penetrates to the class students: "There is a joke among my female students, that the day that I come with films and special toys is a sign that the day before I was at the community. In my students' name and in my name – thank you very much." It is possible to see that a year later (Feedback, 2017), he was exposed to new knowledge, the creation of physics games, and already was confident in himself to attempt to perform this by himself in the classroom. "In the meeting the games that Andrei created were presented. I really liked them. It is clear to me that I will use these toys to enrich my teaching in the classroom." He continued to describe information sources from which he himself can learn and afterwards teach in the class. "We were exposed to Sabrina's website, where there are summarizes of all the topics. A site full of content that I was given access to. It is clear to me that I will use this tomorrow in the morning as well." The expert teachers, such as Phillip and Anton, were satisfied from the learning in the Paris community and from the knowledge they added to themselves during the meeting and wrote in the feedback (2017): "Excellent activities and demonstrations illustrate nice principles, both practical and theoretical." "As usual, the meetings are pleasant, instructional, and add knowledge to me, especially in the demonstrations. Thank you."

Andrei, the community instructor, is indisputably a source of content knowledge and an excellent model of pedagogy and diversification of ways of teaching. A new teacher who was exposed in the Paris community to a mentor in the figure of Andrei has the opportunity to build for himself professional knowledge and to form a professional identity

because of the instructor's considerable experience. Nico, a new teacher, was enthusiastic from the meeting and wrote in the feedback (2017): "Andrei is a model for imitation in my opinion, a professional, serious, providing a place for his students, investing, and developing. In my opinion, the different methods he uses to teach are prominent – nonstandard and thought-provoking experiments that cause you to think in-depth about things. Andrei let his students lecture about a topic that interests them – I immediately adopted this in my class! In Andrei's high school there is mentoring by older students of younger students – I am attempting to realize this idea in my high school already next year. The bottom line – physics is fun – Andrei enjoys and gets excited – we all get excited and take the enthusiasm to our students."

When teachers research together their teaching, they clarify their goals and beliefs, develop new knowledge, and learn from the ideas and experience of others. In this they extend their knowledge on their students' learning and enrich their own toolkit. Even very experienced teachers, such as Bob and Larissa, still continue to create restructuring of their professional knowledge. They noted in the end assignment (2018) that they got to know in the Paris community tools and technological skills that can help them mainly in their individualized work with the students: "I learned just how much the lesson became more interesting when a computerized element was attached to it. I got to know websites and how they could be an aid in my work. I learned that it is possible to use the computer also to examine the students and to respond to their work in an immediate and personal manner for each student. I discovered how much I have more to learn and grow wiser, and to constantly update using computerized aids that are innovated all the time." … "The tips that we receive in the community, like the movie time, toy time, or physics in pictures, give me ideas how to interest the students. The lesson becomes effective."

The activity in the community that engages in the teaching processes was intended for the restructuring of the teachers' professional knowledge. In every meeting, the teachers engage in different activity and from a different perspective, which contributes to in-depth learning and internalization of the processes. This spiral learning, from different directions, ensures the meaningful learning of new knowledge and the broadening of the knowledge of the community teachers.

4.1.3.6 Implementation of Contents and Materials

For teachers to implement in their classes the content that they have acquired in the community, it is not enough that they experience one-time activities with their students. For the assimilation of innovations, repeat experience is required. The implementation of a new activity only once will not create a meaningful change in the teacher's teaching methods. In addition, the absorption and assimilation of contents will be performed only if reflection on the results is performed. Hence, the teacher is required to analyze the activity he held in the class and to carry out the adjustments required for his students. The repeat experience after the change and adjustment will be more effective and will advance the assimilation of the innovations in the teacher's practice over time (Levy et al., 2020). Some of the teachers in the Paris community implemented the contents and made use of the materials presented in the community. In the feedback (2019) that Roman, an expert teacher, wrote: "I have participated in the communities consistently for a number of years. I greatly enjoy the in-service training because of its very practical nature – it is always possible to immediately implement some of the contents if not all that was learned there." It is possible that the many years during which Roman has come to the communities and been exposed year after year to activities when he is accustomed to their nature created a process of rapid assimilation of the materials.

In many of the contents and strategies presented in the community, the activity is divided into three stages. At first, there is independent solving, when each teacher individually engages in the activity. Then they divide into groups and together discuss the answers of each one of the teachers. This discourse forms collective understanding and the discussion focuses points that are not clear in the activity, since every teacher brings his interpretation to the required solution. In the last stage, the teachers gather together and a representative from each group shares the insights that arose in the discussions. Then a summative conversation is held, in which the problems that arose are refined and comprehensive conclusions are drawn (Levy et al., 2018). The experience of the community teachers in the three stages enables them to realize themselves the advantages inherent in this method of action. The first advantage is that the teachers solve themselves what they expect their students to solve afterwards. The experience enables a discussion to

be held about the activity in the groups and in the plenum. Proposals for improvement are presented, and the necessary corrections in the teachers' opinion are suggested, and all this is before the activity is presented in the classroom. Consequently, the teachers come to the classroom full of experience and knowledge about what is expected to occur among their students. The second advantage is that the teachers' experience as learners enables them to recognize the contribution of the three stages of the solution. This can encourage them to use in their classes the method they experienced in the community.

Alina, an expert teacher, addresses from this perspective the absorption of materials presented in the community (Feedback, 2019). In her opinion, to implement new contents in the class, first it is necessary that the teacher solve himself the activity, as a student. Only after the teacher has himself experienced the subtleties of the activity and understood all the hidden meanings, only then can it be held in class for the students. Alina solved as a learner many contents learned in the community during her years of work and is expert in the three stages method. It is possible that her comments derived from her successful personal experience of the activity that she later held in her class. She addressed in the feedback (2019) the strategy that has the goal of assessing the student's previous knowledge. "Diagnostic questions are a strategy whose importance is retained throughout all the years of the teaching. Self-experience in the diagnostic questions in the community and only then holding them in classes help every year to understand and concentrate the students' difficulties." She brings up an intriguing interpretation from a different perspective: "It is interesting that in the same question in the different year's different perceptions can be discovered." It is possible to understand from her words that she has used this strategy for a number of years already.

The staff of researchers at the Weizmann Institute for Science engages in the development of a repository of research-based diagnostic questions for physics teachers in Israel. The questions are multiple choice questions and serve as an instrument of assessment for the teacher, intended to clarify easily the students' perceptions on a certain topic (Eylon & Bagno, 2006). In this way, the teacher can compare between the perception of the concepts accepted in physics and the perception existing among the students. Many of the physics concepts are not intuitive to the students and sometimes even contradict their previous knowledge. Hence, many students develop erroneous perceptions that make the

learning of physics difficult. The goal of the diagnostic questions is the encouragement of learner-focused teaching in which the teacher monitors the students' difficulties and can choose activities directed at the treatment of these difficulties for the group of students with the same mistaken perceptions. The feedback of many teachers in the Paris community confirms that the teachers assimilated the diagnostic questions in their teaching routine. In one of the meetings, Andrei, the community instructor, brought his students to lecture in front of us about select topics in order to expose the teachers to another possibility for the diversification of the teaching. In this method of peer teaching, strong students lecture to the physics students in their age group and to younger ones. The thought behind this method is that a physics topic conveyed by an age peer, even if it is complicated, will be better understood. Sophia, who is a novice teacher, was impressed by the idea in which students teach their peers and even teach teachers and wrote in the feedback (2017): "The activity is very meaningful from my perspective, there was the presentation of the student's work. I left the presentation with a strong desire to cause my students to present their knowledge, to teach others, to be enthusiastic from what they see and to encourage cooperation among the students themselves. The fact that the students present their work to other students and even to other teachers inspires pride both in the student and in the teacher. I will definitely attempt to implement this with my students."

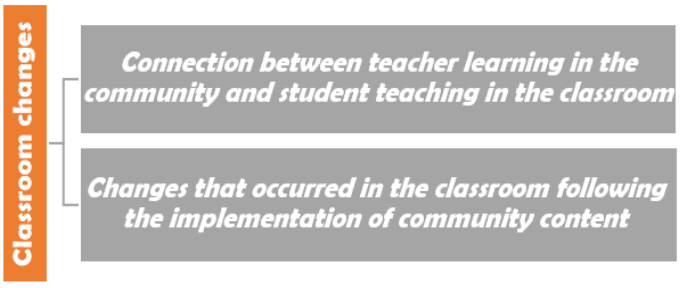
She described additional contents she acquired in the community and adopted for her class. Andrei does not tend to write on the board but on a paper, which is projected to the board by a video camera aimed at the teacher's desk: "This enables the teacher to remain with the face turned to the students and simultaneously 'to write on the board'. In this way it is possible to see the students' behavior, responses, and nature of their learning. There is no need to say that I have eyes in the back!" Andrei explained about the principle of action, the software he uses, and helped every teacher who was interested use this teaching method in his class.

To summarize this sub-topic of the implementation of contents and materials, we bring the statements of Larissa, an expert teacher who wrote in the End Assignment (2017): "In the Paris Community the advantage is the instructors. There wasn't a single meeting from which I did not take an interesting idea for a lesson, an idea how to explain, an idea how to answer, or an example how to behave. The instructor shares with all the community teachers his rich knowledge, in questions and interesting activities and infinite ideas that he has." Some of the success of the

model of learning communities is to create a change in the teachers' teaching ways. If the teachers of the Paris Community indeed implement the contents and materials they acquired, then an impact is created on the change in the students' ways of learning. Research studies show that the information on what the students are required to know characterizes what the teachers are required to know and how to carry out a change in their approach to teaching (Timperley et al., 2008). The teachers need to display responsibility and to monitor their professional development. The teachers are required to perform reflection on the effectiveness of the changes they performed in their practice and will realize that the changes indeed advance their students' learning. For the teachers to carry out change and become accustomed to it, they need time for assimilation. It is best that the teachers examine the changes in practice again and again through daily experience in the classrooms and only then recognize the correctness of the change.

4.2 Changes and Development that Occur in the Class following the Participation in the Community

This section presents the changes and development that occur in the class following the participation in the community.



- To evaluate the types of changes and development that occur in the classroom following the teacher's participation in the community, an analysis of the type of interaction was conducted through the division into characteristic categories.

Two subtopics were chosen: the connection between the learning of the teacher in the community and the teaching of the students in the classroom and the changes that occurred in the class following the implementation of the community contents. In this category, too, there is synergy between the two subtopics – the teacher acquires new

teaching skills in the community and conveys them to the students. The students implement the community contents and change the **learning skills** of the subject of physics, with projection on the learning of the other subjects.

Figure Number 11: The Synergy between the Teaching Skills the Teachers Acquire Following Their Participation in the Community and the Changes that Occur in the Learning Skills of Their Students in the Class

4.2.1 Connection between the Learning of the Teacher in the Community and the Teaching of the Students in the Classroom

The Paris Community consists of teachers from 30 high schools that teach nearly 1000 students, who constitute about 8% of all the physics students in Israel who take the high school matriculation examinations at the level of five units of study (or advanced level high school physics). This is a significant number of students whose teachers are undergoing a continuing process of changing teaching methods. The contemporary learning environment necessitates the increase of the depth of teachers' disciplinary knowledge and concurrently the development of learner-focused teaching practices. Hence, the support of the professional development of physics teachers is essential to the advancement of the achievements of students in physics. In the research literature, there is recognition of the considerable importance of the development of PLCs to the improvement of the teaching abilities and knowledge-supporting means, which empowers the teachers' sense of efficacy in the providing of a response to their students' needs (Dogan et al., 2016).

An example is the report given by Anton in the End Assignment (2018) on the sense of improvement in his students' learning experience as a result of the improvement in his teaching experience. His students expect the innovations he brings from the community

meetings and appreciate the very fact that their teacher continues to learn and to develop. "The meeting with different teachers and focused teaching strategies for different chapters of learning helped me greatly and **improved my teaching experience and my students' learning experience**. This has already become cliché, that the students wait for the lessons that follow the community meetings, anticipating to be exposed to videos, toys, not regular lessons, which present physics in a different and intriguing light. More than a few teachers in the groups (Paris Community) have indicated their students' expectation to see new things following the community meetings. This was similar also with me. First, the **message that the teacher also learns did not pass over the students who were amazed to discover that the teacher does not know everything**. They were happy with every innovation that I brought, especially the videos and the riddles and indicated that they are also interested that I continue to participate in the in-service training."

Anton reported another connection between the learning of the teacher in the community and the teaching of the students in the class. For the first time, he integrated complex research activity when at first he was skeptical whether he should do this at all. The research laboratory was carried out only after he heard the teachers describe in the community, meeting after meeting, the success of the activity that reaped success also among his students. "The initial impression I received from the research activity is that there is complexity and relatively many inputs required for assimilation in the ongoing curriculum, I was skeptical about the success of the process, and therefore I did not rush at the start of the year to integrate it in the learning process. From meeting to meeting in the community of teachers and different prescriptions of the teachers in the group as they tried to combine different activities, I felt more confident in introducing research-based activities. The activities were focused – such as competition of the physics picture, calculation of speed using a smartphone camera. The most prominent measure from my perspective for the success of the process is the enjoyment that is apparent of the students from the carrying out of the research activities." (End Assignment, 18).

The teachers of the community work in groups and experience as learners the activities of a "thought-provoking laboratory". At the end of the experience, the teachers perform reflection of the activities, discuss problems that arose when performing the research laboratory, and bring up ideas for improvement and change. They draw strength and confidence from the joint experience with their peers **in their safe space in the community** and only then dare to attempt to integrate research activities in their classes.

Anton attempted a number of laboratories and defined as success the enjoyment his students felt. It is possible to hypothesize that he feels sufficiently confident and will assimilate this strategy in his way of teaching. Different activities and skills acquired in the community were adopted by the teachers and transmitted to their students in the class. Many feedbacks described the manner of integration and the great importance that the teachers attribute to the new strategies and tools, in the improvement and betterment of their teaching. An example can be found in the statements of Oliver (Feedback on the Meeting, 2016), who presented to the students of his class a model of a room of mirrors after he was exposed to it in one of the community meetings. Following this, a number of girls who learn physics and dance decided to perform a project on this topic since a room of mirrors is the place in which they spend much of their time in dance rehearsals.

Figure Number 12: Meeting that Addressed Mirrors and a Room of Mirrors that Inspired Students

Another example of changes that occur in the classroom can be found in Larissa's statements in the feedback (2017) on the implementation of ideas and how they are received by the students. She reports the use of innovative strategies and methods of teaching in her class that caused students to acquire new skills and concurrently to enjoy the lesson. "I used in my class ideas I received in the community. For example, to make nice times in the lesson: video time, toy time, picture time. The students really loved searching for videos with physics meaning and findings toys build on physics principles we learned. I sent this type of

assignment to the WhatsApp group of physics students in the tenth grade and the **children called the group PhysicsFun**. In addition, for almost every lesson I asked to prepare, to demonstrate, and to explain an experiment. This idea I adopted from the community, and it was also successful."

Physics is considered by the high school students to be the most difficult and complicated of all the domains of science they learn. But when students engage in tasks that motivate and challenge them, they discover that the study of physics becomes enjoyable (Guido, 2018). Larissa's students chose to call their WhatsApp group "PhysicsFun", thus indicating without a doubt that they enjoy learning a subject considered technical and complex. They themselves create knowledge through videos and toys and thus make the lesson intriguing and enjoyable. Roman, an experienced teacher, created for his class an independent learning experience in another style. He adopted a strategy he got to know in the meeting in which students of Andrei, the community leader, lectured to the teachers: "An activity that influenced me especially was a meeting in which Andrei invited a number of students so that we would gain impressions from the activities that he holds in his class, in which every student chooses a topic and lectures before his peers. The lecture was enriching, thorough, and in-depth. The lecturing students demonstrated considerable expertise and delivered the content most fluently, with the skill of an experienced lecturer and thus managed to captivate the community teachers. At the end of the lecture, all the community teachers stood and applauded in their honor. I was so impressed by the high level at which the students conveyed the content that I decided to adopt this activity in the classes where I teach. One of my conclusions was not to compromise on the level and quality of the lecture but to demand from the students (and also to guide and help in all that is necessary) until the level is satisfactory." (End Assignment, 2017)

The process of self-learning of the student, who teaches his class peers, causes him a deeper understanding of the material. The topic is assimilated in memory, and he can make future use of the learned information. The idea behind the model of peer teaching that excites Roman is a process of self-learning that develops responsibility for learning through enjoyment. The teacher who enabled the process benefits both the empowerment of the student and the increase of the motivation for the meaningful learning of physics. It is recommended to physics teachers to adopt teaching approaches that will create enjoyment in the class and thus the learning will be effective and efficient. The teaching of physics that will cause interest and curiosity may contribute to the understanding of the

learned topics and the entire learning process (Guido, 2018). A class in which the students enjoy, are interested, and are curious will learn better and will achieve higher achievements that will bring the teacher satisfaction and enjoyment. An example is the emotion-inducing words of Rose in Meeting 9 (2018), in which she described the composition of the class she teaches. There is a group of strong students who pull the entire class forwards. Because of these students, she succeeds in advancing in the material at a rapid pace but does not lose students along the way. "When I have a class of champions I simply rejoice. I run with them forward and feel the wind on my face."

4.2.2 Changes that Occur in the Class following the Implementation of the Community Contents

The communities of teachers are a platform that enables strategies learned and attempted in the meetings to penetrate into the classrooms. It is clear from the teachers' testimonies that changes do indeed occur in the classes. We will state the reservation that the changes do not occur in all classrooms and not at the pace that the project thinkers expected, but much more slowly. It is clear that it is not easy for the teachers to adjust to the new teaching methods and accordingly it is not easy for the students; however, the assimilation develops and broadens to more and more students. In Meeting 5 (2017), the teachers reported the success in the activity of diagnostic questionnaires. The feeling of improvement in the quality of the students' scientific reasoning was especially emphasized. The duty of reasoning in each section causes the students to deliberate and thus sharpen their understanding of the solution. This fact well illustrates the contribution of the activity to the students' learning and increase of their depth of understanding in the formulation of a scientific reasoning. Diagnostic questionnaires, which are processes of teaching for the incorporation of knowledge, enable the students to reveal the mistaken perceptions and previous knowledge they bring and the teacher becomes aware of this knowledge (Eylon & Bagno, 2006). The work in groups enables the students to compare the knowledge and to conflict with the answers of their group peers. The plenary discussion gives the final approval to the new knowledge that the students have acquired and ensures meaningful learning of this new knowledge.

Figure Number 13: Teachers of the Paris Community Experience as Learners and Work in Pairs on the Diagnostic Questionnaires

Changes occur in the class not only through the introduction of processes for the integration of knowledge. Teachers draw ideas for a successful lesson also from the demonstrations performed in the community. They empower the basic activity for higher levels of inquiry, experimentation, presentation to the class, and additional aspects that enrich the learning and create high order thinking. An example can be seen in Harry's statements: "An activity that impressed me in the community and was illustrated in the class and created great enthusiasm among the students. Following the activity, the students were asked to find the in-depth physics explanation that stands behind the phenomenon. The students invested great efforts to understand the phenomenon and to connect it with the topics learned in the classroom. Later they were asked to present the phenomenon and the explanation to the entire class. The benefit was two-fold: both the learning in an experiential manner and the empowerment of the students who stood in front of their peers in the class and explained the phenomenon to them in simple words (but correct ones)."

Another activity that creates changes in the classroom is the performance of non-routine research laboratories in which the teachers experience as learners. In Meeting 9 (2018), the teachers noted that it is easier for the students to adjust to a thought-provoking laboratory since they are not fixed on traditional experiments and receiving routine instruction as their teachers are so accustomed. The carrying out of an experiment in a laboratory itself constitutes an exceptional activity and an intriguing process from their perspective. The excitement and the interest intensify in the laboratory and thus inspire

thought when they are required in addition to plan the experiment themselves. The experience in groups in thought-provoking laboratory activity is an example of a research project that empowers the collective knowledge and the professional development of the science teachers in the community. The shaping of the project and the research that the teacher then instructs in the class will give his students a holistic and realistic viewpoint of the research in contemporary science fields (Vossen et al., 2020).

The perception in the class changed also following the integration of multimedia means that address physics issues and are relevant to the students' world. One of dozens of videos we showed in the community engaged in Newton's Laws. Joe, a novice teacher, two years in teaching, presented the video to his students and wrote: "In the community videos are presented and an entire lesson can really be built around them." He noted that after the video was shown in class an intriguing discussion of the topic developed between the students. "The video produces first much curiosity and wondering whether it is possible or not, and then a discussion of the forces in action." He added and wrote that the interest led to the search for additional videos. "After the discussion in the class, and out of the curiosity we turned to watch different videos that engage in the same issue. The lesson was very lively, interesting, and the students came out with a better understanding of Newton's laws and the force of friction." Regarding the influence of the community contents on the students in his class, he wrote: "Already this year I shared the knowledge (from the community) in the class in more than a few lessons". Taking into consideration that he is a novice teacher, it is possible to understand the following things: "It is hard for me to address the students' influence, since I do not have enough experience and comparison from previous years. Nevertheless, it was possible to see that in places where I was enthusiastic about the new way of teaching, the students were also enthusiastic, and a lively discussion developed in the class with more than a few questions on the students' part."

Changes that occurred in the class following a change that the teacher made can be found in Roman's words (End Assignment, 19) about the waiting time. This strategy was presented in the community, and in it the teacher is asked to wait a minute after he asked a question and not to turn to the first student who raises his hand to answer. This waiting time is intended to enable more students to gather their thoughts, form an answer, and dare to participate in the lesson. This change in Roman's teaching way penetrated into his class.

"One of the meetings that most influenced me addressed the teachers' tendency not to give time for thought but to turn quickly to the first student who answers, and in many cases just to answer themselves. Following the discussion on the waiting time, I became aware of the fact that I too tend to act this way, and since then I try to wait until most of the students have managed to think and therefore the circle of participants in the discussions has greatly widened."

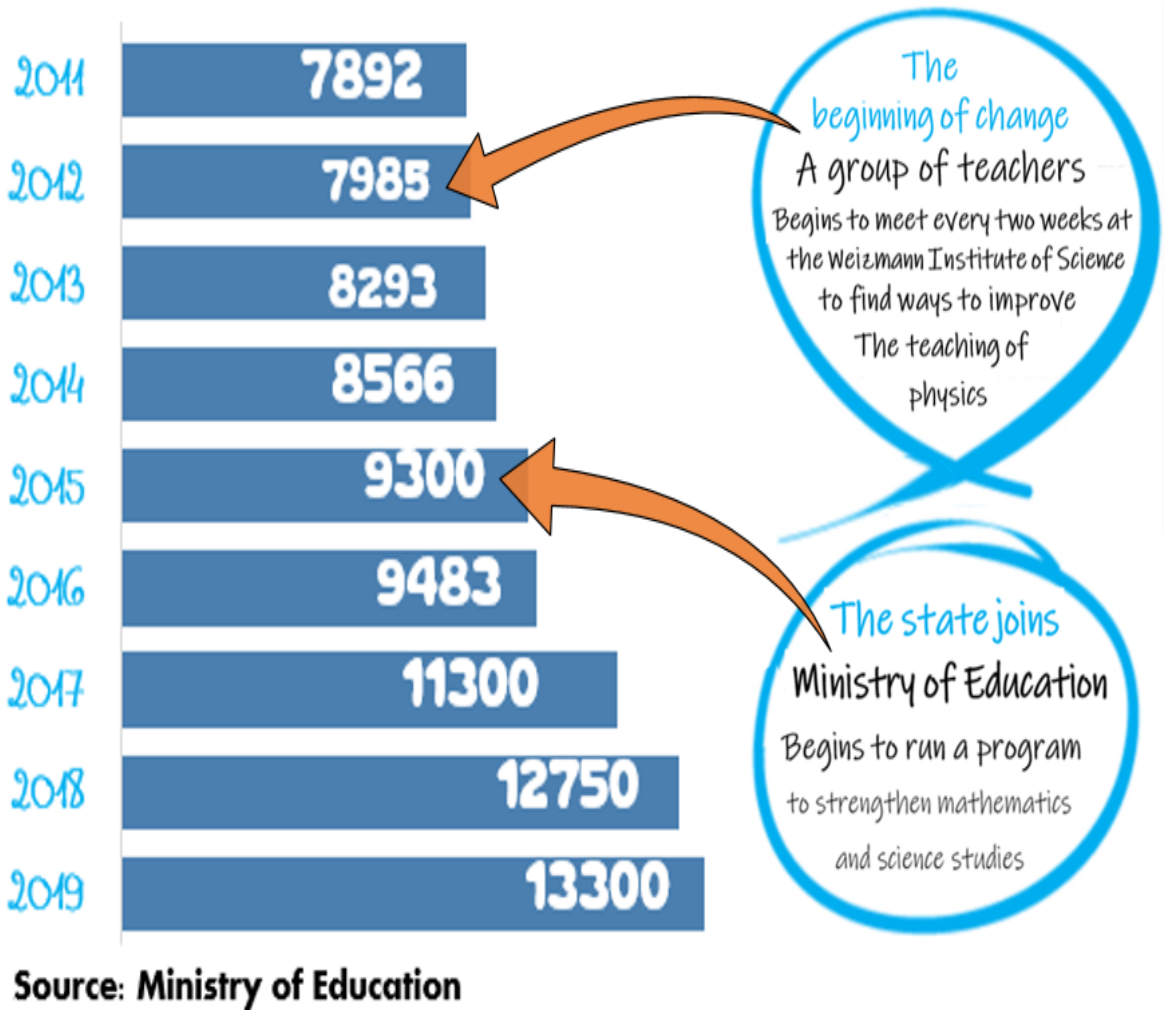
The use of a toy to demonstrate a physics law or phenomenon is a strategy presented as a regular ritual in the community meetings that created a change in Mark's class. "Many times, I discovered that through the presentation of a toy or idea to the class great motivation was created among the students to learn the topic in-depth." He described his students' great interest and curiosity: "The students, by themselves, began to ask the questions in everyday life 'why does the phenomenon appear in the way it appears and not in another way?' This enriches and increases the motivation to learn among the students." (End Assignment, 2017). A short activity like a toy, video, or demonstration that can be easily integrate in the regular lesson framework, without the need for an essential change, always makes the community teachers enthusiastic. This is a way to diversify the lesson and make it more enjoyable and relevant. The materials presented in the community are available to the teachers immediately at the end of the meeting and allow them to innovate, refresh, and air out the lesson without the need for special adjustment to their regular way of teaching. The creation of enthusiasm in the teacher will result in the students' enthusiasm in the class and will create a change regarding the subject of physics.

Mark was influenced by the meeting in which a student lectured before the community teachers on the research work he performed: "The student stood and presented proudly while display self-esteem in the presentation of the topic he had researched, and all from his self-learning." He was impressed by the student and generalized to systemic changes that occur in the class students. "This event gave me a mirror image of the nature of the changes that we create in the field among the students, on the important tools that we give them, and this as a continuation of their training and coping in their future path of studies." He extended on the tools that the teachers obtain in the community and give to their students. "Abilities and tools that helped the students, whether in the research or in the presentation of the topic, can influence in their manner of reference also other topics from different areas that will be in their way, which they are required to address, to analyze, and even to draw conclusions." (End Assignment 2017)

It is possible to learn from the collection of examples that the teachers brought from their classes that there is a relationship between the teachers' perceptions about their role as effective teachers and the effectiveness of the learning and interest that the physics students feel. To summarize, it is possible to generalize that the changes that occurred in the class were caused by the fact that the teachers changed the perception of their role in teaching. They shifted the focus from the content that they teach to the way in which they teach and the experience they create for their students (Buabeng et al., 2018).

As proof, it is possible to sense the change in the following graph, which presents a significant increase in the number of physics learners.

Figure Number 14: Increase in the Number of Physics Students in Israel



4.3 Attitudes of the Teachers towards Their Participation in the Community: Motives and Difficulties

This section presents the attitudes of the teachers towards their participation in the community.

- In this part of the findings, we will present the teachers' voices and their attitudes towards the participation in the teachers learning community in general and in the Paris Community specifically. The interviews, the observations, the conversations, and the written feedback present the teachers' positive attitudes towards the participation in the community of physics teachers. All the teachers agree that there is considerable benefit for the teacher who is participating in the learning community, but a number of voices of criticism were heard that should be taken into consideration and improved to the extent possible. We will divide the findings into two categories:

- Positive attitude of the teachers: motive to participate in the community
- Critical attitude of the teachers: difficulties, dissatisfaction, and changes required in the community

4.3.1 Motive for the Participation in the Community (How Does participating in the Community Contributes You?)

The participation of the teachers in PLCs indicates the long-term professional growth they experience. Research studies indicate significant changes in knowledge, approach, and attitudes of the teachers to the entire teaching process. The community provides an opportunity for teachers to research actively their manner of teaching, to carry

out reflection on the practice, and to analyze the results while learning from their fellow teachers. The biweekly sessions enable the cultivation of cooperative, active, and meaningful learning of the teachers. They provide them with continuous support on the part of their colleagues who undergo similar experiences in a respectful and nonjudgmental environment (Levy et al., 2020).

The teachers' motive in coming to a community is social and professional. In PLCs they receive the support they need, both in professional terms and in social terms, in order to advance their professional development, to practice, to express an opinion, and to discuss with colleagues the students' learning. Teachers see great professional importance in the focus on the students' learning, but for this purpose they must first of all be learners themselves (Martinovic & Horn-Olivito, 2020). The community allows the teachers to attempt as learners all the strategies presented to them, to examine, to discuss, and in an intelligent decision to choose whether to take to their class what they have learned and what is required to improve. The group conversations after the experience enable deliberation on the one hand and cooperative learning on the other hand. The 'community' creates a support network, confidence in the strength of the group, and the desire to learn from one another.

The high return that the teachers receive from their very participation in the Paris Community is described in feedbacks, end assignments, interviews, and observations. They defined their motive to come every two weeks to the session in the tremendous profit obtained in different fields, for example, feeling of experience in the community, experience of professional learning, satisfaction, receipt of contents and materials for implementation in the class, social-professional advantages, and shared leadership. In addition, attention was given to the influence, contribution, and support of the leaders of the Paris Community regarding the teachers. The chapter on the feeling of experience is divided into two parts: social and professional – the experience of the coming to the community and satisfaction from the session and the experience of the professional learning.

4.3.1.1 The Experience of Coming to the Paris Community, Satisfaction from the Meeting

The teachers of the Paris Community come from a different academic background, unique outlook, and schools with a different student composition. Consequently, they undergo together during the year of activity processes of getting to know diverse perceptions and adjustment to different work patterns, with an empowering experience of a social session. All this is done out of mutual appreciation of their colleagues' opinions and during the learning that is accompanied by a sense of satisfaction and enjoyment. The collaborative culture is expressed also in gestures, jokes, and looks that symbolize sympathy and understanding. The sense of community is expressed in the interest in the personal life and not only the professional life, in the acceptance of the other, and in the gratitude for the sharing of ideas and resources. The teachers' expressions on the issue of the experience that the very coming to the Paris community is felt well in the words full of appreciation, recognition, and praise that Phillip wrote in the feedback (2017). "If there is a point of light during my work it is the community meeting" … "As usual the sessions are pleasant, teaching and adding knowledge to me, especially in the demonstrations. Thank you!"

The cooperative culture appreciates and esteems every teacher both as an individual in her own right and as a member who contributes to the group. Thus, a community was built that constitutes a corpus of knowledge and a network of support and assistance with social and professional capital. The community increases the effectiveness of the teachers' work, strengthens their confidence, and encourages them to be open and involved actively in the means of the improvement and change of their ways of teaching (McLaughlin et al., 2006). It is apparent from the words of Emily (session feedback, 2018) since she enjoys coming to the Paris Community. The collaborative culture creates for her a new view and a refreshing look at the teaching and the professional and social capital constructed in this group. In her words, there is reference to the refreshments served at the meeting and creating for her openness, involvement, and a relaxed effect that allows for small talk: "I greatly like the activities in the teacher community. The relaxed atmosphere, the interesting lessons, and everything is very very pleasant. We are a community of many participants and diverse, both novice teachers and experienced teachers, and as an experienced teacher this gives me a different

perspective, brings me back to the days of innocence … each one of the community members had a role in the meetings and this is really nice!" … "There was a fair division of the burden of the refreshments, which added a refreshing and delicious touch to every meeting" … "I must note that the relaxed nature allows for an open conversation, and also allows me to present topics that are not completely clear to me to the end, or to discuss with my colleagues how to present this or that topic without fear" … "It is funny to think that I do not find any disadvantages in my community. Let's remain like we are and continue onwards" … "Andrei and Daphne create a perfect combination for me, as instructors." … "I have no doubt that I will participate in the teacher community also in the next school year. (Especially if Daphne and Andrei continue to instruct the community.) The in-service training is wonderful!! Interesting, fun, and belongs directly to my world. I did not miss even one meeting."

The teachers of the Paris Community come regularly to all the meetings and barely miss any. They note in the feedback that the participation gives an empowering experience and feeling of pride to be a part of a quality group. It is possible to understand from Emily's statements that all the meetings become meaningful for her and for her fellow teachers and therefore nobody misses or is late to a meeting. The feeling of community and belonging is high, and the teachers feel that they simultaneously contribute and benefit. The novice teachers note that they were not absent from the meetings and left every meeting with insight and learning. Nico, a novice teacher, was impressed by the considerable diversity between the teachers of the Paris Community and wrote in the End Assignment (2017): "I found an expert community with a wide range of teachers, older and younger, experienced and new, stubborn and willing to consider changes" … "Andrei and Daphne welcome me very nicely!! With a smile, with patience, and with the desire to give me personally the tools that I need. There were always wonderful refreshments ☺ I came to every meeting happily and expecting to learn new things and indeed I learned."

The teachers of the Paris Community indeed are different from one another in their opinions, ways of teaching, academic background, and teaching experience. Their participation in the community creates connections, interfaces, partnerships, compromise, and adjustment to one another out of a promoting conversation. The teachers described in feedbacks the Paris Community meetings as empowering, fascinating, and meaningful. The atmosphere in the meetings was pleasant and close, with the encouragement of

creativity, shared thinking, and desire to advance the teaching processes. An example can be seen in the statements voiced by Larissa, who summarizes all the professional contents she acquired and notes also the pleasant feeling, the satisfaction, and the experience in coming to the Paris Community: "We finished another year in the community. So, what I will remember: refreshments, advice, laughter, exchange of ideas, toys, stories, and points of light, physics of the story, video-didactics, laboratories and experiments, many ideas and a good mood. Thank you very much to Andrei and Daphne!" (End Assignment, 2018)

Sometimes, following the constraints, the community meeting is not face-to-face but is a virtual meeting (e-meeting) in which the teachers receive a task to perform at home. At the end of Meeting 5 (2017), a proposal was raised to make Meeting 6 virtual. Rose, who comes from far away, refused. "Not an e-meeting! It is really fun to meet! Even if I come from far away." This is another example of an experience that the teachers feel when they come to the Paris Community and want to meet with the friends. The satisfaction with the social meeting exceeds the difficulty in coming after a busy day of work and a long trip.

It is possible to summarize that the first part of every meeting in which there is an effort to forge the community and break the ice indeed was successful. The teachers of the Paris Community feel a feeling of the experience of coming and satisfaction with the meeting. They are cohesive, enjoy the company of their peers, and describe the meeting as an interesting, helpful and contributing experience. The first part is intended to build the community and deepen the familiarity between the teachers, while creating reciprocal trust and cooperation. The second part, the academic part, is intended to create professional satisfaction and a learning experience. The two parts, each in its own way, create synergy and a feeling of meaningful and empowering professional and social development.

4.3.1.2 The Learning Experience

It is possible to define the learning community as a meeting of teachers who are interested in examining in a methodical manner their practice and professional knowledge in order to improve their ways of teaching. In the PLC the teachers themselves are the learners, learning from one another and from the instructors. Thus, for them an opportunity is created to strengthen their sense of self-efficacy and their belief in their ability (Waldman

& Bloder, 2020). The community environment allows the teachers to cooperate, practice, reflect, and learn from peers on topics that are important and relevant to them. **The joint learning in the community is a process of the creation of knowledge and not only receipt of knowledge and this is the meaningful innovation, in contrast to the regular in-service training in which the instructor is the source of knowledge.** However, for the teachers to want to develop in the professional field, it is necessary to give a place of respect also to the social field and enjoyment in the learning. From an emotional perspective, the meetings of the Paris community constitute for the teachers a support group in which it is possible to draw strength, unload difficulties, and consult on professional content without fear of criticism. The meeting draws closers the teachers who share the same feelings, problems, and professional difficulties and allows them to continue to improve and advance professionally. Roman described the support and feeling of relaxation in the Paris Community and the motivation for attending meetings in the feedback (2019): "I am an ardent supporter of the idea of communities. On the one hand, the community provides professional knowledge and innovation in teaching methods. Exchange of materials and more."

The Paris Community is very diverse and is composed of both expert teachers and new teachers. The teachers of the Paris Community, regardless of experience, participate, listen, teach, and learn. All this is performed without 'ego' and with an abundance of humility and the desire to improve the students' learning and ways of teaching themselves. Over the years, a strong community was built that became a meaningful factor in the help of the new teachers and in the cross-fertilization of the expert teachers. The meetings of the Paris community create renewed enthusiasm from the teaching and instill a feeling of belonging to the place that creates in it knowledge, friendships, and professional development. A senior teacher like Anton describes his learning experience, which does not depend on age and experience. "A small but nice thing that I learned during the in-service training is that it does not matter what your experience is as a teacher, it is always possible to learn new things. In the community with us more than a few older and experienced teachers participate, and nevertheless they learned new things in the in-service training. For me, this is especially important if the learning experience becomes routine for me, it is hard for me to believe that I can be a teacher over time" (End Assignment, 2019)

The community culture that develops influences in many circles the learning experience and the motivation for learning. The first circle is created from the social motive: the teachers of the Paris Community declare that they come with great enjoyment to the meeting. They do not count hours but are happy to come to learn, and the proof is that they stay even after the end of the meeting and continue to discuss among themselves and with the instructors. In the second learning circle, the experience of the meeting creates a higher motivation to learn. The teachers become meaningful since they create knowledge and build new processes of teaching that are more precise for the teacher and the student. In the third circle, a learning experience is created as a result of the cohesion between the teachers of the Paris Community. The partnership creates commitment to learn and advance. Intimacy and responsibility to create knowledge suited to a burning topic that arises from the teachers' needs in the Paris community are created.

Figure Number 15: Circles of the Learning Experience

The partnership enables the teacher to feel as if he has entered the lesson in his colleagues' classroom and learns with him and from him. Mark said to one of the teachers in Meeting 6 (2017) after watching videos of the teacher's students: "I feel that I am coming to your class." This sentence indicates the motive to come to a community with cohesion, a feeling of community, and a shared learning experience. In the same context Alina, a very experienced teacher, said in Meeting 5 (2017) when she solved a complicated question directed to her by Mark, a novice teacher: "An old generation produces a new generation." This

sentence emphasizes the commitment to learning of the community teachers and emphasizes the mutual guarantee and help. Alina returned to the community after a year of absence and described her learning experience. She praises the refreshments, the instructors, and her fellow teachers and even notes that she will continue to come to the community even if she retires from teaching. "I am happy to say that after a break of a year and because of the leading teachers, my colleague friends who participate, and also the refreshment (primarily the soup), I discovered the community again. An excellent place to meet with people, to get new ideas, and to be updated. I hope to continue to participate in the community activities also next year and in the years after, despite the planned retirement." (End Assignment, 2019).

Every meeting in the Paris community begins around the dining table. The teachers come after a long day at work, tired and hungry. They find an aesthetic and attractive table, full of light foods and hot soup, with the fragrance of home cooking.

Figure Number 16: The Spectacular Dining Table with the Steaming Soup Pot at the Paris Community

The idea to have soup at the Paris Community was suggested by the laboratory assistant, who with correct instincts felt that a warming, bonding food that will make teachers feel at home was necessary: **coming to the community – coming home**. The community meetings are held similarly to a friendly and warm meeting of friends or work colleagues, with utmost attention to the issues and challenges that occupy the participating teachers. The teachers of the Paris Community feel that they came 'home' and that they can share without fear the needs and challenges that bother them. Like in every group, in the learning community it is important to give a place to the relationship and emotions in order to obtain a good learning experience. The relationship between the community teachers is close, respectful, and appreciative, and therefore the learning bears considerable fruit. The strong connection between the teachers of the Paris community creates relaxation in the meetings, and as the teachers feel more comfortable in the community, the learning experience is more effective. The family feeling constitutes a factor that influences the learning of Jack, who wrote in the end assignment (2017): "The feeling in the Paris Community is excellent. Like a family. The instructors Andrei and Daphne are champions in the subject and contribute considerable knowledge and joint work in that they complement one another. Andrei is an expert in demonstrations and building systems of different types and going in-depth into the physics topics. Daphne is an expert in the work programs and integrating them in the class while emphasizing the professional knowledge. In this she helps me greatly build my work program in the school and bring the students to the finish line in the period of time I have." Jack's motive in coming to the community and his feelings in the meetings did not change even after two years. In the End Assignment (2019), it is apparent that there is no feeling of being finished. "I am participating for the fourth year in the Paris teachers' community and feel as if I am in a family. I learned much from my fellow teachers in the community and the excellent instructors Daphne and Andrei." Anton's learning experience also derives from the enjoyment in the social meeting. He noted in Meeting 8 (2017) that despite the differences of opinion between the teachers and despite the fact that every teacher in the Paris community holds another opinion: "We all advance to the same goal and in the same direction." Jack described in the protocol of the Conference of Communities the learning experience and his motive for coming to the community:

I want to tell you thank you very much that you created such a community. Truly this is not an in-service training, it is fun to come, really, for something that I wait for, I enjoy being in it, and the atmosphere between the teachers truly is something amazing that there isn't in other places. Really a very very special community. I also want to tell Andrei thank you for all the knowledge and the patience over the years and all that he taught me. I feel that I really learned and he was really a teacher for life and how to be a teacher of physics. The most important thing that I learned from him I think, **when I began to be a teacher I thought that the teacher does all the lesson plans and that's it. We are done, you can this way teach all the time**, and the most important thing that I learned from him is that you need all the time to renew and all the time to invent new things and all the time to improve. This definitely I obtained from the community and especially from Andrei. Thank you very much.

There is broad agreement on the teachers' need to continue and to develop professionally in order to improve their quality of teaching and consequently the students' learning (Timperley et al., 2008). The learning community is an excellent place for the physics teachers to acquire knowledge, implement it, forge their professional identity, and undergo a process of personal and professional empowerment that leads to expertise in teaching. In the Paris Community the teachers learn methodically and over time in order to improve the teaching and for the learning in the school to be of quality, current, beneficial, and meaningful. The fact that the teacher needs to continue and to learn, to continue and to develop for all his professional life, appears in Larissa's words in the End Assignment (2017). Although she is an expert teacher, she has been making certain to participate in the Paris Community for five years continuously and her motivation for coming is mainly the possibility to consult with colleagues. "A teacher must learn all his life in order to be attractive and interesting for the students. The sources of learning are books, the Internet, and one of the best sources is good teachers, their colleagues. Such a possibility is obtained in the community meetings

in which I feel that I am not alone with my questions and problems. I get ideas for demonstrations, activities, and mutual contact with professional colleagues. I thank the instructors, and I will be happy to meet next year."

The learning in the Paris Community relies on the experiences, difficulties, and challenges that the teachers themselves bring up in every meeting. The discussions, discourse, and learning are performed for the teachers, by the teachers themselves, and not by an outside instructor. The learning experience focuses on what the teachers know and what they do in the classes, and therefore there is ownership of the knowledge. Oliver provided an example of the motive for his coming to the community following professional discussions that promote values of commitment, autonomy, collegiality, and self-efficacy. "I greatly enjoyed the discussions held on the physics problems that were in the community (whether about issues in the learning material – such as the focusing of problematic concepts – or whether beyond it). For example, the discussion on the demonstrations of Andrei with the boxes was very enriching professionally." (End Assignment, 2018).

To summarize this chapter, it appears that the learning experience is a part of the motive for coming to the Paris Community in which the learning is mainly social and the teachers are involved in the process of the inculcation of knowledge and the construction of new knowledge according to the needs that arise from the field.

4.3.1.3 Receiving Resources for Implementation in the Classroom

The teachers who come to the Paris Community are exposed to innovative and diverse contents – worksheets, activity, video, toy, demonstrations, laboratories, and so on. In the beginning they attempt contents as learners; in other words, they answer the activity / assignment as they maintain that their students would answer. After a plenary discussion and drawing conclusions, the teachers hold the activity in their classroom and return to the community at the next meeting with a critical review, ideas to improve the product, and changes required in their opinion. In the discussion held in the Paris community, the teachers present the products of the activity and tell about difficulties and successes in their class. The conclusions are passed on to the Weizmann Institute researchers, who make changes to the activity, return it to the community for critical review, and the activity is passed on to the students once again. Only after the final approval of the community

teachers, are the corrected materials conveyed to all the teachers in Israel. Hence, the topic of the contents delivered in the meetings is very important, in the opinion of the Paris Community teachers.

The pedagogical idea that lies behind this pattern of action is that the community teachers have peers with whom they can share the implications and experiences in the implementation of the new contents. These characteristics create an atmosphere of change and facilitate the teacher's practice in the introduction of the changes into the classroom (Clarke & Hollingsworth, 2002). One of the motives for coming to the community that Jack noted in the End Assignment (2017) is receiving resources that help him introduce a new topic into the curriculum: "Many activities this year were very beneficial and contributing, like the integration of toys in the learning, experiments we did in the community, worksheets on different topics, demonstrations and lectures that the students held." He specifically addressed the activity that particularly contributed to him: "The activity that I most remember as one that contributed to me and influenced me this year was the activity on the topic of capacitors. This year the topic was returned to the curriculum of physics students and a situation was created in which we had to have taught them it when we still had not crystallized a curriculum and we had not built a suitable laboratory for capacitors." He describes the activity: "Daphne went over with us emphases in the curriculum and together we succeeded, I hope, in deciphering what the program includes in the topic of capacitors and what it does not include. Using this activity, I built the lesson plans for this chapter. In addition, Andrei built a laboratory activity on capacitors and helped us with excellent ideas for measurements using simple equipment that exists in every school. The teachers described how they prepared an experimental design in their school and thus we all together succeeded in improving the experiment and building an activity with learning value."

The feeling of community that motivates the teachers to come to the meetings in the Paris community derive in part from the fact that the teachers share with one another the range of activities they carried out in their classrooms. The resources that the teachers bring from themselves in combination with the resources that come from the Weizmann Institute create a pedagogical advantage. In addition to the diversification in the ways of the teaching and advancement of processes of understanding, the increase of motivation to learn is created among the physics students of the community teachers. The interest in physics is strengthened, and improved interaction develops between the student and the

teacher and among the students themselves. This contribution is built through the constant exposure to current information and a continuous learning process. The teachers of the Paris Community evaluate the resources that they obtain from their colleagues and mainly the fact that the proposed activity is already prepared for deployment in the classroom and there is no need to carry out adjustment to the lesson. "We received teaching aids, worksheets and a map of concepts, everything is already prepared. It is not necessary to change anything, only to deliver to the student as a rehearsal for the test." (Feedback Meeting 2, 2018). One of the main ideas in the community activity is to provide materials for "tomorrow in the morning". In this way, the teacher will attempt in the community the activity so that already the next day he can deploy it in the classroom. A localized activity adapted to the specific chapter in the curriculum that is required to teach in the same period of time in the schools. Another teacher addressed in the feedback the same activity but appreciated more the instruction that she received how to create such an activity herself. "We received a map of concepts – this is the presentation of strategy for the organization of knowledge for students. They explained to us also how to prepare the map of concepts with the students at the end of the process of the studies so that the student will know to summarize by himself every topic that will be required." A large number of the teachers note that they will take the prepared resources and will use them in the classroom exactly as they are. There are teachers who will use the materials that they received as a basis for the creation of a unique activity of their own that is tailored exactly for their students. In each one of the cases, there is emphasis on the sharing of knowledge between the students, the building of knowledge, and cooperative work that is based on the considerable experience accumulated among the community teachers.

In addition to the worksheets and laboratories, the teachers are also exposed to toys, animations, and videos that suit the illustration of a certain topic in physics. Alina wrote in the feedback of Meeting 2 (2018) on the meeting: "We saw in the toy time a spinner and many activities that can be done with it, in my opinion this can be an idea for an activity evening for students or research work." To demonstrate the spinner, there are many theoretical explanations, physics interpretations, and acrobatic possibilities to set sail on the wings of the imagination. Most of the teachers noted that they will demonstrate the spinner in the class. This teacher took the demonstration of the spinner to completely different other places than did the other teachers. She brought up an idea to carry out on the spinner

research activity such as a spinner on a revolving disk, a spinner with a pencil in the middle – like a top, a lit-up spinner – how is the light created? Another teacher addressed only the possibility of the demonstration. "The exhibition of spinners and tops is amazing, suited exactly to the coming Chanukah holiday and the study of the topic of circular movement that I will start soon." Another teacher took the spinner to other areas, to the development of a physics discussion on circular movement of bodies and equilibrium. "The demonstration of the spinners was fascinating and invites a discussion with students."

Harry also wrote in the same feedback about the many feedbacks that he receives for immediate use both from Andrei and from his colleagues. "In the meeting games and works that Andrei created were presented. I loved them a lot. It is clear to me that I will use these toys in favor of the enrichment of my teaching in the class. In addition, we were exposed to the website of Sabrina, in which there are concise summaries of all the topics in mechanics and electricity. A site full of content that I was given access to. It is clear to me that I will use this tomorrow morning as well. Thank you." Larissa, an expert teacher, was more skeptical. While she was enthusiastic about the video and the toy, which she apparently was prepared to take to the class, "tomorrow morning", she preferred to carry out the experiment herself before she brings them into the class. "I will take to my lessons the ideas of the experiments and toys that I saw, also the video time – it was interesting but I will try first alone at home." She also addressed receiving resources from her colleagues: "Thank you Sabrina. I use her website and the support sheets."

The action axis in the Paris community is not based on the model according to which the knowledge is found among the researchers in the universities. The reverse is true: the source of knowledge and expertise is among the teachers in the field, and it is important to expose them and to make them into the province of all. This model is based on the work experience of teachers in the classroom and thus the construction of cooperative knowledge will contribute to the professional development of all the teachers. In this way, we can improve the ways of teaching to benefit all the physics teachers in the Paris Community and in the communities in general. To summarize, one of the motives to come to the Paris Community is to receive resources for implementation in the class in order to provide a solution to specific difficulties and understand concepts. This is from

providing encouragement and emphasis for teachers to share from their activity with their students and create a collaborative culture.

4.3.1.4 Social-Professional Advantages

To create a professional social atmosphere that advances learning, it is necessary for the community members to have a strong sense of belonging to the group. The teachers are found in a personal relationship with one another and contribute to the group, but also the community contributes to all its members. The reciprocal influence and the ability of people to meet one another's needs reinforce the shared relationships and make the community important and meaningful (Waldman & Blonder, 2020).

The learning in the Paris Community is esteemed by the teachers as more meaningful than learning in routine teaching in-service training. This is because the learning develops from the reciprocal relations and nature of the relationships woven between the community teachers. Every meeting in the Paris Community creates an empowering social community experience because of the special atmosphere that reigns among the teachers. The respectful discourse woven between the Paris Community teachers creates a feeling of a fine social gathering, in which professional stakeholders speak the same professional language. In such a meeting, it is possible to give and receive advice, to learn and to teach, and in parallel also to enjoy authentic social interactions. Hence, the motive for coming to the community is also because of the interaction in the group. It is possible to read this in Ilya's words: "The great advantage of the communities from my perspective is the creation of a relationship with other teachers. The relationship cross-fertilizes the teaching, diversifies it, and renews it." (Feedback, 2017). Over the years, in the Paris Community a united and cohesive group developed with a uniform language and shared learning experiences. An example of the interaction between the physics teachers in the Paris Community can be seen in Jack's statements. "The community members are from different schools and this enables me to receive considerable information from different sources." He emphasized: "A number of experienced friends who participate in the community over the years and constitute its 'hard core' enrich me with the ideas for the contents and manners of learning." (End Assignment, 2017)

A group is strength, and the Paris Community teachers leave with much strength after every meeting. From the personal conversations and professional discussions, they learn not only about the teaching profession but also about themselves as people in general and as teachers in particular. The Paris Community teachers share their experience with their colleagues and thus make the personal relationships between them closer. In addition, they improve in every meeting their teaching skills. The social-professional skill enables the teachers to share both challenges and successes with their colleagues. Alina, a very experienced teacher, wrote. "I come to the communities not for the compensation hours – since I already have a surplus, not to learn the material, but mainly to meet with people, to get new ideas, to update, and many times also to be proud of my students and my work. The lack of jealousy in the community is amazing! Everyone is willing to help everyone to support everyone." (2016).

In the Paris Community friendships and social mutual relationships are created, and this became a friendship for life. The feeling of collective communality is high, and a high level of trust, openness, and group cohesion is prominent. An example of the close relationships can be seen in the words in Meeting 2 (2016) of Karina, whose birthday was exactly on the day of the community meeting. She said that the teachers in her school and her family asked her: "Why does she go to in-service training from the afternoon hours until the evening, and on the day when she has her birthday?" And she answered: "Exactly because of this!! I have a birthday! I am going to celebrate with friends!" This example reflects the social and familial atmosphere in the Paris Community.

Because of the direct and open intercultural dialogue between the teachers of the Paris Community, networks of interpersonal relationships were formed that constitute an infrastructure for learning in the community. A professional learning community, therefore, is the stage for the creation of cooperation between the teachers who adjust to the difficulty that exists between them and develop an inclusive, flexible, open, and conciliatory culture. These traits are especially important to the physics teachers, since most of them are single teachers in their school. Getting to know colleagues is important for every teacher but mainly in the physics profession, in which generally there is only one teacher on the staff. Phillip (Feedback, 2019): "I am a single teacher of physics in the school, like most of the physics teachers, so that the community is a place for receiving feedback on the

method of teaching or a test you composed and receiving the opinion of the peers." The belonging to the PLC requires the teachers to actively adopt for themselves the language of the community and its norms and to participate in the creation of knowledge with meaning and importance to them and the community, or in other words, not only receiving knowledge but also creating knowledge. It is possible to understand this issue also from the words of Roman (2017): "Aside from contents that we share in the plenum, you can consult in deliberations on the order of the teaching of topics, share tests, share in case of a problematic class / sweeping failure in an exam or a specific question from it. The issue gets added value in light of the fact that many of us are single teachers in their schools or in the best case they teach with one colleague and we lack another opinion when we encounter a problem or deliberation, and this is one of the basic needs that the community meets."

Also two years later Roman continues to note the importance of the meeting with other teachers (2019): "I enjoy the opportunity to meet with professional colleagues, in two aspects: in the social aspect this is an opportunity to meet with teachers whom I already know for years but because of the geographic dispersion it doesn't work out to have with them a continuous relationship. In the professional aspect – I am a single teacher in the school in the middle school and it is very important to me to have the opportunity to deliberate and seek counsel with my professional colleagues. I will happily participate next year too."

The perception that lies behind the idea of the PLC shatters the paradigms in learning and requires the teachers to be active in the process. Effectiveness is created in this type of learning following the commitment, the intimacy, and the desire to create knowledge that is accurate for the teachers' needs and arises from the field. The continuous and consistent process of learning in the meeting creates change in the ways of teaching in the professional aspect. In the social aspect, the teachers' meetings are held once every two weeks and during them the relationships between the physics teachers are strengthened. As Phillip described in the End Assignment (2019): "I have been a member of the community for about two years and I very much enjoy the meetings in the community. The meeting with the colleagues of teaching physics is a type of social meeting in which we swap experiences and share with the friends the dilemmas we encounter in the professional life."

The learning process in the Paris Community is connected to the social process in which the teachers transform from passive participants to members of the community who are involved in contents, knowledge, and social interactions. According to Oliver, the community meetings create a feeling of fraternity: "It was very nice to meet all the friends again, to know that we are in the same boat." (Feedback, 2017)

Another social advantage is the very presence of many physics teachers in every meeting, which enables cooperative community work. Most of the learning activity carried out in the community is held in groups. In every group three to five teachers think together about solving the assignment and carrying it out. In this way, a teacher without a professional staff in the school can experience the meaning of teamwork. In this way, the teachers create social interactions and not only professional ones. The community leaders attempt to mix between the teachers so that each time a meeting is created among different teachers, and in the end all the Paris community members discover one another. As a result of the work in the small groups that enable personal interaction, intimate relationships begin to form that strengthen during the year. In the First Meeting 2017, the teachers were divided into groups and were asked to build a tower from marshmallows. The highest tower won. This activity was intended to cause the cohesiveness of the Paris Community teachers and to cause the teachers to recognize the importance of their students' teamwork. Most of the teachers give up on this topic out of the fear that the group activity will cause noise or mess in the classroom. Mark wrote following the activity: "Acquaintance with new members of the community team was created through building the marshmallow tower, which emphasizes teamwork and focus on team strengths. Learning that is inferred from the tower's example to life itself, that is, to pose the challenge in our lives (success in adulthood), learning about early action planning and meeting deadlines" (Feedback at the End of the First Meeting, 2017).

This professional social meeting provided perspective on the rare suitability of the community to the physics teachers' professional and personal life. The community helped the teachers develop the skill of teaching physics, which is not necessarily the development of knowledge in content in physics or general skill in teaching. A feeling of intimacy was created, that the Paris Community is a home and anchor in the professional, personal, and social fields. The teachers held among themselves personal and professional conversations,

offered tools, and shared new professional experiences. Ilya noted favorably this activity that engaged in the advantages of teamwork. "The marshmallow challenge was an amazing activity. It also had us act in a group so that I got to know new people. It was also very enjoyable. It also presented physics and engineering principles in reality and allow them to be implemented. It also encouraged creativity. This is also an activity that can easily be brought into the classroom." (Feedback at the End of the First Meeting, 2017)

The Paris Community is very diverse and is composed of new teachers and experienced teachers so that the human richness creates in every meeting a fruitful and varied conversation. The teachers share materials, contribute from their experience, help one another, and cross-fertilize one another so that everyone benefits both professionally and socially. The Paris Community teachers begin every meeting by sharing experiences, emotions, and ideas, and thus over the years a feeling of partnership on the way and true friendship was created. Along with the social aspect, the meetings are always filled with innovative and meaningful professional contents and create learning that is an experience. The connection and closeness between the Paris Community teachers enable each one to grow and develop professionally, in a friendly, respectful, and pleasant atmosphere and a feeling of family.

4.3.1.5 Respectful Attitude and Reciprocal Appreciation from Colleagues

The teachers in the Paris Community come with different academic backgrounds and with professional experience that ranges from one year to thirty years of teaching. The rich range of the colleagues creates ramified social ties based on trust, respect and mutual appreciation. In the professional community where teachers trust and respect each other, a powerful social resource is created for cooperation, support and reflective dialogue. As the relationship between community members becomes dynamic, trust, respect and mutual appreciation become stronger, and so the social resources shared by community teachers develop and expand (Bryk et al., 1999).

A prominent example of the respectful attitude and mutual appreciation that the Paris Community teachers feel can be seen in the activity of the demonstration of the lesson. In the framework of the time slot "My class", the teachers present to their colleagues an example

lesson to the best of their understanding and knowledge in the learned topic. In the continuation, a respectful professional discourse on the different teaching approaches and ways of presentation of different topics in physics develops. All is done through considerable respect of the colleagues' works and from great appreciation of the colleagues' willingness to enable a look into the class. Nina noted the great contribution obtained from holding a sample lesson by the community teachers. She enjoys seeing in every meeting another teacher presenting a teaching strategy, an interesting lesson, or a technique for the community members. She maintained that the sharing of this knowledge indicates the excellent system of relationships created among the community teachers. "Three years ago I joined a community of physics teachers – a framework of meetings in the community is for me enjoyment because of the social meetings with the colleagues close to me and in-depth and better acquaintance of the teaching contents and current curricula. **The experience of all the in-service training members enriches us and we the learning community.** Each one of us holds according to his choice an in-service meeting in which he tells about an interesting experience or presents a unique lesson, brings up a demonstration experiment or an activity experiment for the purpose of learning. Towards the physics Olympics questions from tests that appeared in the past are analyzed and bring to the in-service training the personal evidence and unique point of view."

There is reference in her statements to the fact that in the analysis of the problem solution every teacher brings his personal perspective and everyone learns from everyone. Her statements are commensurate with the definition of the learning community, in which the teachers are cross-fertilized from one another. She continued to cherish the mutual appreciation that prevails among the members of the Paris community and also referred to the personal connection between the teachers: "The subject of physics is linked to all our doing in everyday life so there were teachers who chose to present the physics behind their hobby. For example: a teacher in the group who plays the trumpet, brought the instrument, played in front of us and held an amazing lesson on sound wave propagation in the air." (End Assignment, 2017).

A respectful attitude on the part of the teachers of the Paris Community enables the asking of questions that sometimes express weakness or lack of mastery in physics. The teachers ask and those expose their vulnerable side since they feel safe and protected in a system of relationships based on openness. The teachers allow themselves to leave their comfort zone and tell also about the lack of success and know that their colleagues'

evaluation of them and their trust will not be harmed as a result of the exposure. The attitude of respect and mutual esteem between the teachers can be felt also in the words of Karina, who compares between the community at the start of her path and the community that developed and expanded after a number of years: "The community now is more family-like despite its huge size. The excellent connection created between the in-service trainees and the shared and experiential learning created in-service training that is not given up easily. This is in-service training in which the number of in-service trainees increases from year to year since we enjoy adding friends." (End Assignment, 2017).

The Paris Community teachers appreciate one another and share successes, failures, and experiences. The reflective discourse reveals another perspective from the peers, and thus professional growth is made possible. When a teacher shares and feels appreciated, a sense of belonging and communality is created: I contribute to the members of my community and members of my community contribute to me and we all benefit. An example of the feeling of respect and reciprocal esteem is: "I feel very comfortable in the Paris Community and am happy to meet with my professional colleagues. The meeting is most fruitful, and even in the breaks we get to share things, to seek advice, and to be helped by our professional colleagues." (Roman, End Assignment, 2017)

The professional mutual sharing in the Paris Community creates a social process in which the information of each one of the teachers becomes collective knowledge. An organizational culture develops based on the considerable experience and professional knowledge accumulated during the years of the teaching of every teacher. The integration between the contents that come from the experts in the Weizmann Institute and the knowledge accumulated among the teachers creates a fine pedagogy based on sharing. Novice teachers share their fears, experienced teachers contribute from their experience, the instructors bring the experts' voices in the fields of education, and together the community creates a strong professional backbone. Oliver appreciates the interaction and the sharing between the teachers and enables a perspective also from a teacher's eyes: "This is the third year in the PLC. In essence, since the first year I have been a partner in the community of the physics teachers – something that was very important to my adjustment as a novice teacher." He describes the benefit that he derived from the broad human variety that enables him to grow both in the teaching of physics and in physics: "The people of the community – the physics teachers – in

part experienced and expert and in part young and lacking in experience – constitute a combination of a social framework and professional framework. The instructors have very great professional experience, and it is possible to learn from them much both in the field of the physics content and in the field of the ways of teaching." In the following sentences, it is possible to feel the mutual esteem and respect that he feels for his colleagues and community leaders: "The instructors inspire a very comfortable atmosphere to bring up the problems that arise in the school and the community members display interest, cooperate, and posit solutions to the problems. And therefore, I intend to participate also in the coming year in the community of teachers." (End Assignment, 2018)

Other voices are also heard on the issue of the learning in the community, but they too reflect the colleagues' appreciation. The sharing of the materials, the support, and the openness create relationships of respect and mutual appreciation and enable a group discourse on actual topics and professional discussions that are fruitful for all. Nevertheless, Ilya feels that he did not learn enough professionally but in his opinion the social meeting is no less important. "**I do not feel that I learned much in the community** – but I opened channels for learning through cooperation with other teachers. The community is an important tool and I am happy to be a part in it." (Feedback, 2017).

A respectful attitude and mutual appreciation can be found also in the professional discourse of the teachers of the Paris community. The discussions and conversations are meaningful and powerful tools for the purpose of the building of the knowledge in physics and teaching. In the professional reflective discourse, the teachers respond, provide interpretation, and learn to know challenges in their colleagues' professional work out of mutual respect and evaluation. Larissa appreciates the knowledge she receives from her peers and finds in the community a place that creates learning. "The community members adapt themselves to one another and find together responses to the specific challenges of the subject." It is possible to feel the respect and appreciation that she feels for her colleagues. "The community becomes a place in which it is possible to acquire and adjust learner-focused teaching strategies and thus to diversify the teachers' teaching competencies." She describes the advantages of the shared learning: "In the community an atmosphere is created of cooperation between the teachers." (Feedback, 2017).

The cooperative culture in the Paris communities enables a look into the knowledge found in each one of the teachers, exposes and brings it up, and leads to a renewed perception of the teaching. The new professional strength built together promotes among many teachers a change in the approach in teaching. An up-to-date worldview is created that stems from the community and the appreciation for colleagues from whom the knowledge came. All this can be performed only in a community with a respectful attitude and mutual cooperativeness that enables the teachers to be helped in their work on their colleagues' abilities and thus to develop professionally.

4.3.1.6 Group Discourse Contributes to Professional Topics

The professional contents in the PLCs were developed in cooperation between academic staffs in the Weizmann Institute for the leading teachers who bring up the needs of the teachers in the field. The fan approach in which knowledge comes from above and seeps down gradually became interactions and collaborative learning, leading to a "role change" that included a more symmetrical division of responsibilities among community participants. These interactions in the PLCs created a developing "network model" of the transfer of knowledge (Eylon et al., 2020). The teachers develop professional conversations and bring up difficulties in the teaching of physics and difficulties in the learning of the students. The community leaders transfer the information, the requests, and the questions for the professional staff in the Weizmann Institute. Thus the knowledge that arises from the extensive bottom to the head and the responsibility for the knowledge becomes active and shared and not passive. In addition, there is the confidence in the academic backing that is provided by the Weizmann Institute that allows the teachers a professional group discourse knowing that every question that will arise will receive an accredited answer. Reinforcement is found in Oliver's words: "I greatly enjoyed the discussions around physics problems that were held in the community (whether in the learning material – focusing of problematic concepts – or whether in beyond it). Taking into consideration the fact that this is my main in-service training during the year, it is important in my opinion that the topics of the physics content not be neglected and from this perspective I was very happy that indeed time was dedicated in the meetings also to challenges in this topic." (End Assignment, 2016).

In recent years, the physics teachers are forced to adjust to frequent changes in the curriculum dropped on them in the middle of the year by the supervision of teaching physics. A community meeting is an excellent opportunity to discuss these actual topics and the changes required to be carried out in the planning of the teaching. Oliver expressed satisfaction with the fruitful discussions and professional discourse between the colleagues. He emphasized again two years later (2018) the advantage in the shared seeking of advice in the community. This is following a surprising decision of the supervision of physics to divide the high school matriculation examination. The decision was made in the middle of the school year and surprised the physics teachers in Israel. "The community was an excellent forum for advice on the issue of the advantages and disadvantages of the division of the high school matriculation examinations decided upon in the middle of the school year."

The teachers of the community who discuss professional issues find the community also as a place in which it is possible to criticize the curriculum and discuss its relevance. Phillip, an expert teacher, noted: "In the period in which I am teaching physics, the curriculum underwent more than a few changes regarding the curriculum I learned as a high school student and taught at the start of my path. In my opinion, some of the changes take away from the knowledge that a physics student in the 21st century is supposed to know at the end of his high school students and this criticism I bring up mainly in the framework of the community of physics teachers." (End Assignment, 2019)

The head of the PLCs of physics teachers in Israel explains in the Conference of the Communities (2021) that a community is not only a fun and enjoyable meeting but also a methodical and continuous process of learning and thinking each time. What is the role of the teacher? What is the teaching of physics? How would we like our students to learn? She addresses in her speech in the Conference of the Communities (2021) the reflective group discourse of the teachers on professional topics: "Activity in the community is a continuous process … in active and collaborative learning, reflective conversation of the teaching and learning through focus on the learning of our students and ourselves… We speak together about the teaching as a basis for thinking, deliberation, renewal and all this happens when physics is at the focus. This is the idea of disciplinary communities. The goal of all of us is shared, to advance the teaching of physics."

The academic backing provided by the scientists of the Weizmann Institute to the community teachers is of great importance. The teachers feel confident to discuss professional topics since they have regular access to the experts in the field. The answers obtained from the scientists can provide an answer to the questions in the teaching of physics and in physics itself. This availability of professional expertise in the community of physics teachers is not possible in every framework of professional development. This availability provides a sense of confidence to hold a group professional conversation and to raise questions for discussion. An example is given in the interview with Emily, in response to the third question about the benefit in her being a member of the community. She told about being a single teacher in the school. In her words, the professional conversations with colleagues that she meets in the Paris Community create for her a power multiplier. If she encounters a difficulty during the lesson, she tells her students that she will check the topic. Emily emphasizes that she intends to bring the difficulty to the community and to discuss with the rest of the students the problem that appears in the class. In other words, the group conversation on the professional issues provides her with a solution to problems she found it difficult to solve. From the interview with Emily:

133 If I have a problem or I encounter some difficulty, I have somewhere to bring this difficulty
134 to. Always when I say to the students that I will check this, I mean that I will come to the
135 and I will ask. This is something that greatly helps me.

The professional conversation in the Paris Community enables reflective dialogue and clarification of attitudes. The discussion creates effective learning of physics and the teaching of physics. The conversations enable a renewed collective examination of the students' learning, effective teaching methods, and learning from success.

4.3.1.7 Shared Leadership

Simultaneous with changes in the knowledge of the teachers and practice, the sense of shared responsibility, leadership abilities, and collegiality in the community are strengthened. The teachers experience research-based learning, scientific argumentation, and learning for the purpose of assessment, until they become experts and obtain a new perspective on teaching through shared learning in the community (Dogan et al., 2016).

The Paris Community is a cohesive community with relationships of trust and a strong sense of community and collaborative work. The teachers' active learning brings with it the experience, expertise, and professionalism of the peers. The learning is cooperative and not hierarchical, and there is no monopoly of knowledge by the instructors of the academic backing of the Weizmann Institute. The teachers' contribution, each in his own way, enables the research of teaching and focus on the students' learning and on the improvement of the teaching and learning. Phillip, notes in the End Assignment (2016), the group work and the shared leadership and expresses esteem for his fellow teachers. "I greatly enjoyed the meeting with the professional colleagues. I really liked the group assignments, the conversation, and the cooperation. I liked the humor that is rather shared by all the physics teachers. I was very impressed by the quality of the participants, mainly that some of the participants engaged in the past in different areas from teaching and share their experience." In the end assignment three years later (2019), Phillip extended on the issue of the shared leadership and added a picture that illustrates the feeling of cooperation and collegiality among the teachers in the Paris community: "This year too, I greatly enjoyed the in-service training, enjoyed conversing, sharing, and seeking advice with the community members. The great advantage in this is that **each one of us brings knowledge** and thus, with shared strengths, we cooperate and provide considerable information for discussions. The community to which I belong is very supportive and they listen and cooperate." In the following examples, he describes the shared contribution that creates new knowledge. "I am exposed to different teaching methods and approaches of different topics. I see rather simple demonstrations that explain physical phenomenon and experiments that we teach in the school so that I learn all the time new things from expert teachers, members of the community. The community gives me mainly the possibility of sharing and learning from the experience of others." Phillip attached the picture and described his choice of it. "As is said, 'a picture is worth a thousand words', so I will summarize with a picture all that I wrote and all that I experienced during the community meetings."

Figure Number 17: Cooperation and Teamwork. The Teachers in the Picture Work Face-to-Face, Together

One of the motives for coming to the Paris Community is the feeling of the creation of new knowledge in the community – not only to receive contents but also to create contents tailored to the teachers' needs. The source of knowledge and the source of power are the teachers themselves, who in their leadership succeed in creating accurate and well directed materials for their students. Thus, the teachers of the Paris community create energy and double the power for every action of each and every teacher individually. Even Joe, a new teacher who tends less to connect and speak, appreciates the shared leadership. In the end assignment (2019), he expressed a different point of reference and choice of a picture that reflects him accurately. "I have been a member of the community for three years. The meetings in the community give a lot to me. Since I am a single teacher of physics in the school, I do not have on a daily basis the possibility of seeking advice from colleagues, and this is a wonderful opportunity for an open conversation on professional, pedagogical, and bureaucratic topics that are related to the teaching of the profession. In the community there is the sharing of knowledge and experiences that enrich me and produce thoughts what can be strengthened and what can be preserved. The community is very meaningful for me and I believe that I have gained more than a little from the meetings. The feeling of belonging to a community of physics teachers – open conversations. The understanding that the problems with which I cope are shared by many others. Humor, empathy, and openness to my ideas and others'."

The picture that he chose reflects ideas and shared but not friendly learning. The people in the picture do not hold hands and do not look at one another. This picture reflects his behavior in the community. He less participates in discussions around the table and less tends to share but still is a part of the shared leadership that shapes the collective knowledge in the community.

Figure Number 18: Cooperation and Teamwork without Social Interaction

Teachers come to the community in order to develop professionally and are influenced both by the community instructors and by the other teachers. There is no monopoly on wisdom and professionalism. The knowledge that comes from the colleagues is appreciated to the same extent as the knowledge that comes from the instructors. To create such a collaborative atmosphere, it is necessary to solidify the members of the community and create a sense of pride in the very belonging to the community, in the very act of belonging to a leading team, which learns together and discusses openly and honestly while giving and receiving criticism.

The leaders of the community, but also the teachers, are responsible for the feeling of shared leadership. The instructors and teachers hold relations of trust and openness that enable learning circles through the creation of a feeling of belonging to the community and the formation of the professional community. Karina wrote on the issue of the formation of the community. "The community that solidified in Paris is very united and very professional. Andrei still is with the same love of teaching and still is full of ideas and there is no meeting where I do not learn from him something new. Daphne also excites us each time anew with interesting videos of the leading teachers in the Weizmann Institute." (End Assignment, 2017)

Jack summarized that he learned in the community during the year from his fellow teachers and the community instructors. The list is long and diverse and touches upon all the areas of teaching physics. It is apparent that the year of activity is full of welcome activity and shared leadership from which the teachers develop professionally and personally. "The participation in the Paris Community contributed to me with considerable professional knowledge. Learning from the instructors, the sharing with other teachers, and shared learning advance me greatly as a teacher. I learned this year a number of main things: Laboratories – how to carry out laboratories in a more correct manner relevant to the material. I got to know additional ideas for carrying out laboratories that were not known to me, through other teachers in the community. Thus the participation in the community helped me improve the laboratory designs and derive greater benefit from the laboratories."

In the following examples, Jack describes useful strategies and contents that he acquired from his colleagues and adopted for his class. "Demonstrations – in the Paris community instructors and teachers excel in demonstrations with the help of toys and games and

various visual means of illustration. It's great fun to adopt these ideas in the classroom, and to improve the quality of my teaching and increase the students' enjoyment of physics."

He continues and describes the strategies that his colleagues and the community instructors, shared and learned. "The opening lesson – my fellow teachers presented in every meeting different ways to start the lesson. I learned from my colleagues that a correct opening helps create interest and understanding among the students. The preparation of an opening lesson that includes demonstrations or an experiment will be excellent for the creation of interest among the students, will cause enthusiasm, and consequently will create cooperation with the teacher. There is no doubt that Andrei and Daphne are very experienced teachers, and it is a pleasure to receive from them tips and new methods for teaching in the classroom." (End Assignment, 2019).

The community instructors encourage the teachers to bring contents and knowledge of their own and to present to the colleagues teaching methods that succeeded or techniques they developed. The instructors and the teachers together, in shared leadership, create the community, which becomes a place in which it is possible to ask questions, discuss, and in most cases also to obtain answers. In a cohesive community where teachers also bring content, there is an opportunity for learning, updating, rejuvenation, and enrichment through cross-fertilization.

Nico, a new teacher, explained the motive for coming to the community in that he can grow through shared leadership with colleagues. "Naturally it was clear to me that I had to continue to develop in the teaching of physics, to learn additional teaching methods, to hear experienced teachers, to ask endless questions, and the place to do this was the community. From a short clarification I understood that Paris is close and good." (Nico, End Assignment, 2017).

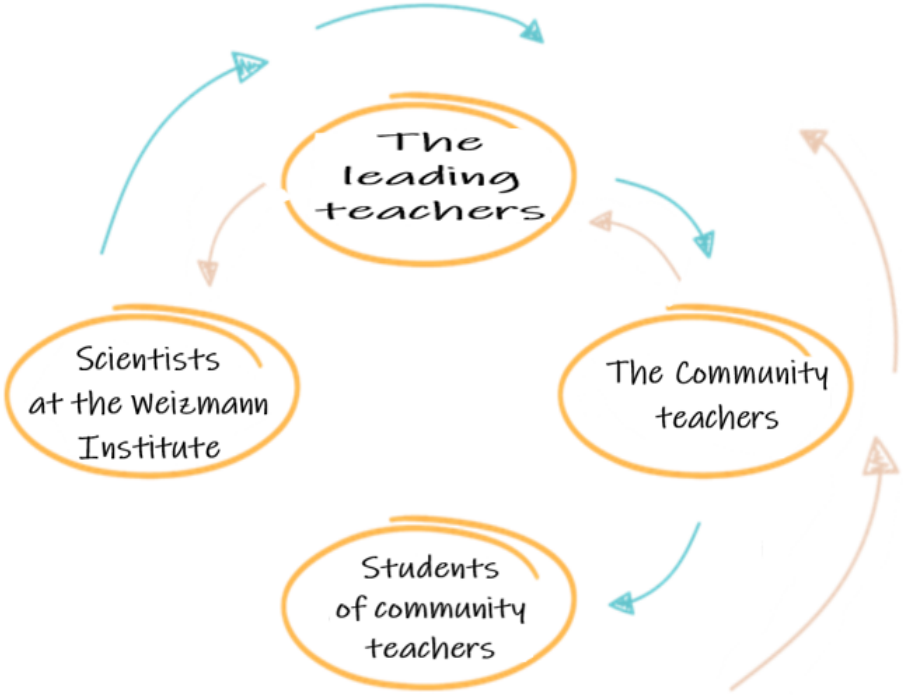
The shared leadership in which the Paris Community teachers built collective knowledge created for them inspiration for additional ideas. A community that succeeds in creating shared leadership will enjoy more responsible and dedicated teachers, who share knowledge, are effective, and mainly are satisfied with their participation in the community. The teachers of the Paris Community influence one another in a continuous and reciprocal process that increases the social interactions between them. There is a positive correlation between shared leadership and sense of growth and change under the influence of the partners for effective leadership.

4.3.1.8 Circles of Learning, Comparison of Teaching Pace with Colleagues, and Becoming Up-to-date

In the learning community where teachers who come with different professional backgrounds participate, the teachers' knowledge and teaching strategies are built together. Hence the community is an excellent platform for the improvement of the personal pedagogical knowledge of each teacher and the collective knowledge of the group (Vossen et al., 2020).

The teachers build knowledge from the contents that come from the Weizmann Institutel. After the implementation in the class, they return with insights on the activity. The teachers' comments after the performance in the field and the criticism on the contents are returned by the leading teachers to the scientists of the Weizmann Institute. The academic staff is helped by the criticism of the community teachers, improves the contents, and again sends the contents corrected with the leading teachers' help for re-exposure in the community. The circle of learning and creating is shared for the scientists of the Weizmann Institute, the leading teachers, and the community teachers.

Figure Number 19: The Two-Way Learning Circle



Nina brought evidence of this and shared that during the innovative teaching of students, difficulties are sometimes discovered and the students themselves advise her on ways to improve. In the community meeting, she brings up the problem and the ideas for improvement, and thus the community teachers make decisions for change. "Many of the innovative ideas in the fields of the deliberation come after seeking advice with the students and thus I assume that better decisions are made in the community" (Feedback, 2019).

Nina notes the advantages in coming to the community in that she can compare her pace of teaching to that of colleagues and to carry out changes and adjustments in the teaching program. "Throughout the year in the meetings of the teacher community I met my professional colleagues – I could get updated about the completion of my planned work plans and make a more accurate diagnosis about my pace of progress in the work plans. In a joint consultation and intelligent discussion, I could make changes to the program regarding the degree of depth required in each of the study chapters – to compare the pace of progress of my students to that of my colleagues' students. These meetings solidified in me the urgency to carry out changes about the distribution of the teaching resources at my disposal for the purpose of the optimal completion of the annual work plan. Towards the matriculation examination, we analyzed together the documents that came from the subject supervisor and made the necessary adjustments to the class."

Nina brings examples of the fact that the community constitutes a convenient platform for keeping abreast of changes in the curriculum. She notes the advantages of receiving a qualified and up-to-date answer and emphasizes the extent to which it is possible to rely upon the answers obtained in the community from both colleagues and leaders. "In every question or clarification required for us, we turned to the leaders and they clarified with the supervisor the most current information – while interpreting the documents and the explanation of the rationale of the supervision on the teaching of physics for the purpose of determining these requirements. We were explained where we are given extended autonomy regarding a component of the curriculum on the topic of alternative assessment and thus the meeting with the colleagues in the framework of the community enriched the basket of possibilities at my disposal and allowed me to adjust the unique component to each student for the purpose of the completion of his studies in physics. I see only advantages in my participation in the community of physics teachers. Therefore, I am interested in continuing to be a member in the community also in the coming years." (End Assignment, 2017)

In most of the schools, the teacher of physics is a single teacher, without a colleague from whom to ask advice or obtain support. In the biweekly meetings in the Paris Community the teachers succeed in obtaining an important and meaningful response for the many challenges they encounter and in building shared knowledge for their specific needs. Nico, a novice teacher who is also a single teacher, listed the advantages in the coming to the community and addressed the getting up-to-date with colleagues. "The conversations with the other teachers were the complementary requirement for the community. I received ideas and tips and learned a lesson from veteran teachers both in terms of teaching methods and about the way to harness the students. The instructors gave an opportunity to anyone who wanted to present a film or idea, and it is a welcome initiative that created great wealth. In each meeting the topic presented and the class discussion contributed to me a lot to building lesson plans for my classes. In addition, there were conferences and lectures that made it possible to study, see, and hear a wide range of lecturers and opinions in the field of physics." (End Assignment, 2017).

Roman, who comes from a school that is not strong, compares with the colleagues the pace of teaching and sees in this personal benefit. He examines the conduct of a not-strong school like his school and that of a strong school: "One of the main advantages is the broad human variety of the participants in the community, which in my opinion derives from the geographic dispersion – and the combination of the participants from the south region and the participants from the center region. This enables a diverse perspective of how things happen in the 'strong' schools on the one hand versus schools with more challenging populations, and for me personally this gives added value." (End Assignment, 2017).

The atmosphere in the Paris Community is special and fruitful, and the meeting enables updating at the colleagues' pace of teaching. From the documentation of the meetings, it is possible to see that already in the conversations around the dining table teachers shared experiences from the class and discussed the success of the holding of the activity in the class. The updates revolved around both the contents presented in the present meeting and the contents to which the teachers were exposed in the previous meeting and had already conveyed in the class. The teachers returned to the community with experiences, sometimes successes, sometimes things that needed fixing. The corrections required were conveyed through the community leaders to the core that plans the community activity in the Weizmann Institute and then the materials returned to the

community after the correction to receive further feedback. The learning circles are built so that after the community teachers again held the corrected activity and approved it, it was published on the National Website for Physics Teachers for all the teachers in Israel. **Hence, the conversations and feedback of the teachers on the activities have decisive importance in the shaping of the learning materials for all the physics teachers in Israel.**

It is possible to understand the motive for the participation in the Paris Community in the following table, which reflects the opinions of Nina, a senior teacher, in the start of the year in the PLCs project and after the end of the year of activity. In the table it is possible to see the development and professional growth that Nina feels along with the strengthening of the social relationships and feeling of benefit from the very participation in the Paris community.

Figure Number 20: The Process of Professional Development of Nina – Diversification of Ways of Teaching and Renewal during the Year of Activity in the Community

The Process of Professional Development of Nina – Diversification of Ways of Teaching and Renewal during the Year of Activity in the Community

Expectations Questionnaire at the End of the First Meeting in the Paris Community	Expectations Questionnaire at the End of the Year of Activity in the Paris Community	Comments & Support from the Research Literature
What is your opinion on the idea of a learning community of teachers?	**What is your opinion on the idea of a learning community of teachers?**	
A learning community of teachers - a very successful idea in my opinion. The group and brainstorming in the learning process in general are especially suitable for the group of the teachers of our discipline - physics, because physics teachers teach in schools without a professional staff at all, or alternatively in teams of up to two teachers. The community fills a professional need that exists in schools in most disciplines.	*Amazing, helpful, fun, instructive, and enriching. From the end assignment: I see only benefits in my participation in the community of physics teachers. Therefore, I am interested in continuing to be a member of the community in the years to come.*	It is possible to see that Nina knows the idea of communities since this is her third year in the Paris Community. She notes the importance of brainstorming mainly in the subject of physics in which the teacher is a lone wolf. A supportive professional learning community is a platform for effective professional development (Bolam et al., 2005; Bryk et al., 1999). Physics is considered a challenging scientific subject, and in most schools a single teacher teaches, without a colleague for reciprocal support and advice (Etkina et al., 2017).
What do you expect from your participation in the Paris Community?	**Did participation in the Paris Community meet your expectations?**	
My expectations – for professional advising and sharing of relevant materials for teaching as well as enrichment of the work and getting ideas for innovation and increased efficiency.	*In full!! From the end assignment: Membership in the community enriches the professional knowledge and allows me to quickly and continuously update on all the innovations and changes of the subject.*	Nina's expectations are mainly for professional discourse and exposure to new methods for the purpose of diversification of the teaching and it appears that the expectations were realized. Effective professional development is carried out through active and cooperative learning through reflective dialogue (Berger et al., 2008; Borko, 2004).
Which support would you want to receive in the Paris Community?	**Did you receive support in the Paris Community?**	
Support, sharing of materials, and shared professional in-service training on topics relevant to us all.	*Support of the learning contents. Construction of the curriculum, in time and division of limited resources in the work plan.*	Nina expected to receive a response in a number of fields and described the support she received: (1) Receiving materials that will be used by her to advance learner-focused teaching. (2) Learning and professional development. (3) Power of partnership. Creation of big things together. Construction of curriculum will be a difficult task for the single teacher but when all the community members are recruited and committed it is possible to obtain a significant product. The ongoing experience in the context of classroom teaching and the ongoing support are essential components of professional development programs to enable teachers in order to change their teaching practices (Eylon & Bagno, 1997). The teachers in the PLC receive the support they need in order to advance their knowledge and practice (Vescio et al., 2008).

Would you recommend to a friend to participate in the Paris Community?	**Would you recommend to a friend to participate in the Paris Community?**	
I would recommend to my friend to join and I have even referred physics teachers from other schools in the city belonging to the district.	*I greatly recommend to every teacher to every teacher to participate in the learning community!*	Nina encourages teachers to join her learning community. She does not separate between an experienced teacher who will come for refreshing and diversifying and a young teacher who needs support and a safety network. The joint learning, continuous, in the Paris Community, year after year, enables cross-fertilization and gives a feeling of belonging to the place in which knowledge, partnerships, friendships, and professional development are created. The main idea of the teachers' communities is that they are a place for the improvement of the practice through continuous cooperative learning (Grossman et al., 2001).
How do you feel in the Paris Community?	**How did you feel during the year of activity in the Paris Community?**	
I enjoy in the community the company of colleagues and fulfilling social relationships – not only professionally.	*I am filled with energy, motivation, and new ideas. I feel in the community that I am reviving the enthusiasm I had in teaching, like in the first years when I was a teacher. But now my experience contributes to a far higher level of teaching than in the beginning.*	The intimacy that is created in the Paris Community enables relationships of trust, cross-fertilization, and support. The meetings caused Nina to feel again joyous in the profession, refreshed, renewed, and to stop to think. The renewed enthusiasm for teaching physics stops the burnout and creates a good dynamic of cross-fertilization, ideas, and sharing between colleagues. The teachers in the PLC are characterized by enthusiasm, perseverance, and "desire" to belong, to act, and to develop in the community (Scherz, 2018). The community is a place where the teachers research their teaching to create a sense of identity and enthusiasm from the teaching (Etkina et al., 2017).
What causes you to come to the Paris Community?	**What caused you to come to the Paris Community?**	
The main factor that motivates me to come to the community is the social factor.	*The teachers, the members in the community.* *The end assignment: I find in the Paris Community the supportive staff, of colleagues who share with me their unique activity, convey to me at my request teaching materials and aid materials, and meet with me in the framework of the vacations as friends for shared recreation. Since I am a teacher without a staff in my school, I consider the teachers in the community and its instructors – as work colleagues.*	The quotes confirm that the main factor for coming to the community is not the academic aspect but the social aspect. The work with other teachers constitutes for her means of learning of new ideas, receiving feedback, and support. In the process of the development of the PLC, the teachers create the community relations, search for a common language, and develop the social relationships (Grossman et al., 2001). The professional community requires the teachers to be involved in activity that is both intellectual and social: new ways for collaborative thinking and new forms of interpersonal interaction (Gilad, 2001).
Does it seem to you that you will derive benefit from belonging to the Paris Community?	**Does it seem to you that you derived benefit from belonging to the Paris Community?**	
I derived benefit from the belonging to the community during the last years and continue also this year.	*Considerable benefit!!* *The end assignment: the experience of all the members of the in-service training enriches us and we are a learning community. The meetings solidified in me the urgency to carry out changes about the distribution of teaching resources at my disposal for the purpose of optimal coverage of the annual work plan.*	As a senior teacher in the community, it is gratifying to see that Nina continues to benefit from her affiliation with this group of teachers and feels that she has made important changes for the coverage of the material. In the learning community of teachers, the teachers receive all the support they need in order to advance their practice, outlook, and knowledge (Vescio et al., 2008).
Which contents conveyed in the community can help you with diversifying the teaching of physics in the classroom?	**Which contents conveyed in the community helped you with diversifying the teaching of physics in the classroom?**	
Contents for teaching, ideas for demonstrations and new experiments. Videos for online learning and ideas in	*Capacitors, edge problems, and in-depth analysis. From the end assignment: it was explained to us where we are given extended autonomy on the topic of alternative assessment that*	Nina brought an example of contents that she used to diversify the teaching in her class and acquired from her peers in the community and the instructors. She chose

4.3.1.9 Support, Contribution, and Influence of the Community Leaders (Instructors) on the Teachers

The leading teachers are responsible for the creation of a feeling of trust and confidence in the community, for the collaboration and the communication between the teachers. The community depends on the teachers themselves but the instructors also have a meaningful role in the professional development of the teachers of the community and the creation of an effective PLC (Levy et al., 2020). In the Paris community there is instruction in pairs, by Daphne the researcher and Andrei, a senior and esteemed teacher. The idea behind the instruction of two people is that each leader gives his interpretation to the learned topic. The teachers see that there is no one correct way and every leader approaches the problem from a different angle. In this way, the teachers are exposed to the fact that it is permissible to deliberate ways of teaching and their sense of efficacy strengthens. Along with them, the self-confidence and the commitment to the community increase, and thus an atmosphere of sharing and unity is created. In many feedbacks there was reference to the community instructors, the leading teachers Andrei and Daphne, as having the ability to influence the atmosphere and sense of satisfaction with the class activity and teacher commitment. It is possible to feel the teachers' esteem in Anton's words: "I want to give a special thank you to the leaders of the Paris Community, Daphne and Andrei, who brought from themselves to each and every meeting and made sure that we leave satisfied and informed. I would like to thank you for another wonderful year that you caused us to meet and to feel like a real community." (End Assignment, 2019).

The Paris Community is led correctly, and evidence of this is the feeling of trust in the instructors and teachers expressed in the feedback. The cooperative work and active learning of the Paris Community teachers are based on leadership that is not hierarchical but take into account the teachers' expertise and experience. The knowledge comes from the teachers in the field and the leaders who bring the materials that were developed in the Weizmann Institute. In a correct mix, active learning is created, as well as a feeling of community that enables focus on the shared goal, research of the teaching, and learning of the physics students. Hence, the collaboration in the community leads to the teachers' meaningful professional development. It is possible to understand from the words of a very

experienced teacher like Max the teachers' appreciation of the tremendous effort invested by the leaders in the development of an interesting, beneficial, and professionally advancing community meeting: "I have been participating for two years in the Paris Community, and in my opinion all teachers need to go to in-service training and learn new things. In the community diverse methods of learning are acquired through which it is possible to cause the students to think and to understand: not only physics but also life processes." In his following words he specifically addresses the leaders of the Paris Community and attributes to them the special atmosphere created among the teachers. "There are many in-service training courses for teachers, but only in the Paris Community do I feel the most comfortable, this is because of the wonderful atmosphere between the teachers and the instructors. While in every place there are disadvantages, I do not find such in the community since I can see how much effort is invested by Andrei and Daphne in the planning of the meetings." (End Assignment, 2017).

So that the Paris Community teachers could work together, as a team, with sharing in their students' difficulties, successes, and learning, the instructors must create relations of trust and reciprocity among the community members. If we remember that most of the physics teachers are solo teachers who teach with a colleague in the school, then we will understand their natural tendency to work alone and the importance that the instructors need to give to this topic that needs improvement. The instructors invest effort in the creation of an atmosphere of trust and confidence between the Paris Community teachers, the building of a pleasant learning environment that conveys inclusion, attention, and openness. The leaders in the Paris community are attentive to the problems and needs that the teachers bring from the field. In combination with the experts in the Weizmann Institute, they attempt to find solutions and a response to the different issues. Harry wrote: "The meetings were planned and designed so that they would be interesting on the one hand and in addition would innovate something. It was apparent that the staff of instructors invested greatly in the building of the meetings." (Feedback, 2016). A year later he wrote: "Andrei and Daphne deliver as usual the meetings in an interesting, pleasant, and enriching manner. They are wonderful." (Feedback, 2017).

The leading teachers in Paris created a nonjudgmental environment in which the teachers feel comfortable to bring up difficulties and even to make mistakes. The atmosphere of reciprocity and sharing enables the understanding that a mistake is a source

for growth, and therefore the instructors encourage the teachers to bring up difficulties. The rationale of the community is that it is preferable to raise the problems and not conceal them behind the closed door of the classroom while personally coping. The bringing up of difficulties and the receiving of solutions from the instructors and colleagues enable personal and professional growth.

The Paris Community teachers find the instructors to be listeners of their problems from the strength that they feel in the combined power of the community. Roman addressed the support that he received from the community leaders. "One of the main advantages of the Paris Community is the instructors. Andrei and Daphne bring an abundance and professional richness on the one hand and ease and good spirits on the other hand, with the integration of much humor." He presents an example from the case in which he was personally helped by the instructors and obtained solutions to his problems. "Even when periodically a question arose and I turned to them outside of the framework of the ongoing meetings they always provided a response and also the most comfortable feeling in the world, that they are available and accessible and help immediately even when this is requests that obligate the investment of their personal time – including the clarification on administrative topics of curriculum, relevant contents, or professional advice." (End Assignment, 2017). Roman added: "I greatly appreciate the instructors, Andrei and Daphne, for the combination of professionalism and talent to deliver all the contents in a good spirit." (Feedback, 2019).

Sometimes the instructors do not succeed in providing a solution, even after turning to the experts at the Weizmann Institute. Generally, these are administrative issues of supervision of the teaching of physics. Larissa noted that even if there isn't an answer, there is still a feeling of support in the community and appreciated the instructors for bringing the supervisor to the meeting. "Sometimes the head supervisor of physics is invited to the meeting of the community and there is an opportunity to ask him difficult questions associated with the curriculum, such as how to cover all the material?" She added: "While we did not receive from him a solution, we did receive support and empathy and we understood that we are all in the same boat and in essence I am not alone with these problems." (End Assignment, 2017).

It is apparent from Larissa's words that the community leaders have an important role also in the mediation of the instructions of the professional supervision in topics of the

curriculum. Sometimes there are requirements from the supervision of physics that cause uncertainty and powerlessness. A teacher who is not in the community will feel more strongly the professional isolation in the attempt to decipher the instructions that are not always sufficiently clear. Daphne the researcher, the community instructor, in her additional job, is found in close contact with the supervision of the teaching of physics and therefore she can simplify the new instructions and provide a solution to the uncertainty that the teachers feel. The community instructors interpret the decisions of the supervision and present the considerations that led to the new instructions.

The physics teachers are not involved in the decision making process of the professional supervision and receive with apprehension the new instructions. The feeling of loss of control can erode the teacher's self-confidence in the assessment of his ability to prepare his students appropriately for the high school matriculation examination. Harry emphasized in his words a number of times the tremendous importance that the Paris Community teachers feel in the meetings in which the instructors engage in the instructions of the physics supervision: "I greatly enjoy and benefit from the community. I feel that every time I come to the meeting I leave with new insights both about the learning contents and about the level of procedures and expectations of the supervision." (Feedback, 2016) A year later, he again addressed this topic and noted the confidence that he feels because of the community instructors who interpret the subject supervision's instructions: "In the meeting we received a review of the structure of the high school matriculation examination, which for me personally it was important to know how to prepare and how to plan my learning" (Feedback, 2017). Another two years later he continues to emphasize the importance of the response that the community leaders provide to the instructions of the supervisor of teaching physics: "We receive in the community important and meaningful knowledge both in the context of the curriculum including the changes in it, the updates, and of course the goals and main objectives that were defined by the overall supervision and the supervision of the teaching of physics." (Feedback, 2019). Harry described in the continuation of his statements what his satisfaction from the community meetings derived from and ascribed it primarily to the community instructors who mediate the instructions of the professional supervision. In his opinion, in this way an atmosphere of formation is created, in which everyone is united for the shared goal and together decode the professional objectives. "Daphne and Andrei – a pair of

instructors who complement each other, who generate a pleasant atmosphere in the community, an atmosphere of a cohesive group aimed at a common goal of the professional development of each of the group members. A personal attitude for every member, a place to express opinions and thoughts, and of course the enrichment of the group both in the professional field and in the diversification of the teaching ways."

He clarifies that the instructions that the community leaders bring from the supervision and the interpretation they give to the new instructions, changes, and administrative issues instill confidence in the teaching in him: "In the community we receive an explanation for all the requirements of the supervision in terms of the curriculum and in terms of the procedures that we receive from the supervision. **I have a feeling of security in a community that all that the supervision wants I will know through the community**. I believe that this is a feeling of all the members in the community." In the continuation, Harry expresses his esteem for the instructors of the Paris Community and addresses the atmosphere in the meetings: "I cannot not be grateful for two very special people who lead the community well, pleasantly, kindly, and with genuine caring from each and every one of the members of the community. Dear Andrei and Daphne, thank you for another year in which you led the community, as usual, the meetings in the community are interesting, enlightening, meaningful, invested and also delicious … and all this you do with charm, pleasantly, happily, and most importantly professionally. Daphne and Andrei succeed in causing us in every meeting [to understand] how meaningful and important our presence is there." (End Assignment, 2019).

In the Paris Community considerable emphasis is placed on the existence of laboratories following his love for Andrei for the topic. Andrei, the community leader, tends to develop and to create simple laboratories for implementation, from materials and equipment that exist in every school. These laboratories are unique to the Paris Community and are not presented in the rest of the PLC in Israel. In the pedagogical part of the meeting, the leaders demonstrate the laboratory and afterwards the teachers experience it as learners. In other words, the teachers carry out in groups the laboratory as if they are the students. Everything is accompanied by a theoretical explanation of the topic, cracking hard-to-understand elements, support sheets, and other materials that make it easier for the teacher to understand and perform the experiment. Karina greatly evaluated the laboratory on capacitors that Andrei developed, demonstrated, explained, and taught theoretically: "The

laboratory and the activity in the topic of capacitors was most important since this topic was returned to the curriculum after many years in which it was not taught. The teaching was very important to the new teachers and even refreshed the expert teachers' memory." The value accompanying the community is the construction of activity that will cover the topic from all its side and include in addition to the laboratory also other knowledge-contributing activities. "In addition to the laboratory experiment, Andrei and Daphne initiated interesting enrichment activity on the topic of capacitors. They adjusted to the learned material videos for teaching and even gave us worksheets for the students and questionnaires for the examination of the understanding." (End Assignment, 2017).

Another point for the contribution of the leaders of the Paris Community can be found in the way in which they manage the meeting. The instructors attempt to enable every teacher to achieve self-fulfillment in order to strengthen the sense of efficacy and personal abilities, and indirectly the entire community will benefit. This will cause the empowerment of the community and the development of a feeling of community and belonging. The goal is for every teacher to feel that he has a place of respect, to feel appreciated and desired, to feel that he is a meaningful part of the community. To create this collaborative atmosphere, the leading teachers open every meeting with activity that intends to build the social axis of the community. The initial meeting around the dining table creates an opportunity for closeness and reinforcement of the familiarity between the teachers. Afterwards, the teachers are exposed to the activities intended to break the ice and create unity.

The instructors create routines and rituals that encourage an honest conversation and openness, and the regular ritual at each session allows for the assimilation of new tools. Phillip wrote about one of the same regular rituals in which the instructors retreat from the center of the stage in order to allow the teachers to speak freely and openly. "At the start of every meeting we hold a discussion that is called 'points of light' in which we share with the friends the positive experiences in the fields of the teaching. Of course, we share also the less positive points and the very sharing and receiving of a response constitutes a listener and feedback of the rest of the community members." (Feedback, 2019).

The leaders of the community in these rituals were able to produce a glue that connects the teachers and allows for social cohesion, solidarity and social interaction. Relationships of trust were created that enable cooperation and shared learning on the same issue that Alina wrote, and in her words she confirmed the success of the leading teachers in the creation of a strong community. "The regular time of 'points of light' in which each one can share and shared his small successes or asked for help in the coping with the everyday situations from the colleagues, this is in my opinion the most important time slot. There is nothing like the experience of the colleagues who share knowledge and materials openly." (Feedback, 2019)

The teachers of the Paris Community took an active part in the regular time slots. Not only did the leaders bring activities but also the community participated. These rituals that the leaders instilled in the meetings created an improvement in the community climate, effective communication between the teachers, and the strengthening of self-efficacy and commitment to the community. This created a supportive work environment that enables growth and coping with difficulties while sharing professional knowledge. The fact that teachers share personal experiences and activities they performed with their students also contributes to the sense of community. Max even supports rituals that cause in the end assimilation: "In every meeting we learn methods of teaching physics in the regular times: the picture time, the toy time, the laboratory time, the video time. In the meetings we discuss main things such as the teaching method, discussion of the questions of reforms in education, activities for the encouragement of the choice of the physics study program in the high school, personal work, physics and technology meeting in the classroom, discussion of the new test structure." (End Assignment, 2019)

Andrei and Daphne emphasized and encouraged the teachers to share with one another the experiences in the holding of the activities in the class. The discussions following the experience were primarily in the time slot that opens the meeting: points of light. The repetition of the same times strengthens the confidence and facilitates the assimilation of new strategies. This is true for all the teachers but mainly for novice teachers like Felix, who addressed the regular rituals. "The meetings were understood in a set rubric. I loved the format in which everyone tries to bring and present a new toy in every meeting. We have seen beautiful and interesting things that show natural phenomena in different forms. There were also "points of light" in which each one spoke about something enjoyable that happened to him

with the children that week – this can be a good word from a child or understanding of a topic in physics, or anything that provides 'fuel' for the teacher to want to teach." (End Assignment, 2017).

To summarize, the leaders of the community created in the Paris Community an atmosphere of trust and open communication. In this way, the teachers' self-confidence and sense of professional efficacy increased. The improvement of the teaching is not only the personal goal of every individual in the community but also the shared goal of the PLC. The leaders made certain that the teachers experienced the activities, analyzed their learning, and gave feedback to each other. For this to happen, a supportive environment is required that can only be produced by community leaders. In the Paris Community, the leaders succeeded in creating supportive social functioning that enable all the teachers to express themselves. An extensive social system of relationships, a supportive community climate, and shared channels of communication were created. The personal reference that the teachers feel from the instructors of the Paris Community is expressed in attention, words of sympathy, and looks of understanding and identification. The instructors are interested in the professional life of the community teachers but also in their personal life and are certain to have gestures such as cake for birthdays and events. The instructors in the Paris Community show gratitude to the teachers on the sharing of ideas, contents, and dilemmas. The community leaders **do not only convey material – they accompany the process of learning that the teachers experience** pedagogically through the backing of the academic support of the Weizmann Institute.

4.3.1.10 Support and Accompaniment of New Teachers

In the Paris Community, there are many expert, experienced teachers as well as teachers whose experience in teaching is one to three years. The shared learning of a novice teacher and an expert teacher enables the growth of both sides. The expert teacher regains the enthusiasm for teaching and the spark in his eyes. A novice teacher feels that the instructors in the community and the teachers provide him with a support network, support him, and in this way enable a smooth entrance into teaching. The dynamics between the beginning teachers and the experienced teachers enables reciprocal cross-fertilization, and together they create knowledge through collaborative planning that can serve as a learning arena both for the experienced teachers and the novice teachers (Eshchar-Netz & Vedder-

Weiss, 2021). An experienced teacher in the community noted that he recommends that every novice teacher participate in a learning community. "When I meet teachers at the start of their path who seek my advice on any topic then I recommend to them warmly to join a community, since you receive there far more than it is possible to receive when being helped by a single person." (Roman, Feedback, 2019).

One of the additional roles of the instructors, the leading teachers, is support and accompaniment of the student teachers who come to the Paris Community. Teachers who teach fewer than three years are defined as novice teachers and are required to be mentored – pedagogically, administratively, and systemically. In addition, professional mentoring is also required: to teach, to refine, and to analyze in actuality the professional physics content they must teach in the classroom. Felix, a teacher in his second year of teaching, expressed his distress: "It is hard for a new teacher like me to reach a situation in which he understands every topic well enough to explain it." He wrote that he was exposed in the community to examples that the instructors use as an aid and that are known only to a senior teacher who taught the same topic already a number of times. He addressed the support that he received in the community and the sense of partnership: "Most important were the explanations on the new things in the curriculum that appeared for the first time that year. Otherwise, I would need to cope with them alone." He shares his fears when he is required to teach a new topic after many years of a break and without previous knowledge: "They added to the program 'capacitors' and it was decided in the meetings to review this topic in an orderly manner. This helped everyone, and I know with certainty that I never learned this topic, since it did not appear for me as a student on the high school matriculation examination, and then it did not appear at all in all the studies in the university." (End Assignment, 2017).

The instructors of the Paris community cope with a challenge that is not simple – to provide a response both for the young people for whom all content is new and for the experienced people who have already been exposed to many contents. There is heterogeneity in the community, both in the experience in teaching and in the needs of the new teachers, which are different from those of the experienced teachers. David, a novice teacher, wrote after the first meeting in the community that he was interested in obtaining help since he felt lack of confidence to teach laboratories: "The meeting was diverse and thought-provoking, for me this is the first time and I was impressed that it is worthwhile joining

the community. I would be happy to receive personal direction regarding the demonstrations. I am expert in theory and solving exercises but in all that pertains to the engagement in experiments I am weak and I will be grateful for all help from the community leaders." (Feedback, 2017).

Teachers at the start of their path in teaching build their perceptions and teaching strategies in their new work. Therefore, the contents of the Paris Community emphasize the construction of a protected environment, in which the teachers can share difficulties and dilemmas – a critical aspect for support in the building of the novice teachers' professional resilience. Joe, a novice teacher, feels lack of confidence in teaching and maintains that he has benefited from the meetings in the community: "I am aware of my lack of experience in teaching in general and in physics in particular." He notes the importance of the community in his opinion as a place that shapes the professionalism and professionality. "The community is very meaningful for me. I greatly benefit from the meetings, and it is important to preserve and develop this platform. I thank and appreciate Andrei and Daphne who invest their time for the success of the meetings and develop (in me at least) the love of teaching in general and the teaching of physics in particular." (End Assignment, 2019).

Year after year the Paris Community fills and the experienced teachers return to the community, alongside the novice teachers who join and find a home in the community, a greenhouse, with people who listen and provide advice from somebody a little more experienced than them. The dynamics between the experienced teachers and the novice teachers can stop the burnout and create a feeling of revival and renewal among the experienced teachers and learning among the new teachers. In this way, both sides benefit and develop professionally. The human richness creates diversity and a fruitful discourse in each and every meeting. Sophia, in her third year of teaching, brings up her difficulties and needs in the pedagogical field and in the teaching of physics. "As a new teacher, I lack the more practical tools of the curriculum. I would be happy to professionalize, to know what is the most recommended and understood way for the students to learn, and what is the form of work referred for me, as a teacher, in each chapter of learning." She expresses satisfaction that she has joined a community and received a solution to the dilemmas she experienced primarily from colleagues in Paris: "This year, I joined for the first time a community of physics teachers and I congratulate myself for this. Following the exposure to the diverse ways of teaching of other teachers, I discovered about myself that just teaching can be fascinating. There are many ways in

which I can deliver to a wide range of students the love for the laws of nature and can ignite the curiosity in them." She describes her feelings as a novice teacher who was defined a "little girl" and was the youngest of the teachers in the community: "In the first meeting of the community we presented ourselves and one of the teachers said 'I want to hear the little girl!' … and meant me. This was a rather accurate definition for the feeling that I felt during the year. I was the little girl among all those with considerable experience, the one who has the most to learn."

Sophia finds that in each one of the teachers of the Paris community there is considerable knowledge based on their work experience. It is possible to understand from her statements that she sees importance in that this knowledge will become the province of all the teachers in the community. The collaboration will contribute to the professional development and will help in the teaching work: "The amount of knowledge that flows among the community members during the meetings is tremendous, like the number of approaches and methods." Sophia wrote that she listens to what is said in the community and imagines herself doing this in the classroom and ended her words in that she is not alone in her dreams. "What I did in most of the meetings was to listen, to take with me some of the things, and to attempt to imagine myself doing the things I heard. Over time I understood that I had to filter, that there are approaches and methods of teaching that I do not agree with or do not connect to. Over time I also understood that I am not the only little girl and that there are many other teachers like me … learning and imagining." (End Assignment, 2017)

The Paris Community leaders are attentive to the needs of the novice teachers in order to help them succeed in the first years of teaching. They put effort in each meeting to innovate, to provide a platform for all the teachers who seek to share and mainly to be an inspiration for the novice teachers. Joe described in the protocol of the Conference of Communities (2020) his feelings as a novice teacher in the Paris Community and the support and accompaniment he received from the leaders and colleagues:

I still consider myself to be a new teacher although this is my fourth year. But I still learn every day new things. And I still attempt to re-invent myself. The figure of Andrei was for me very dominant in all the shaping of: what teacher do I want to be? Really! I mention him at any opportunity. In every interview they do with me. In every conversation they talk with me about what is teaching in my opinion and where I want to take physics. So his figure is a figure that inspires inspiration for me… Regarding this community, I also want to compare... I think and I say this with caution There are not things of the type that that we have here in other subjects. In the aspect of sharing, in the aspect of the regularity of the meetings, the sharing of knowledge and materials, which does not exist in my opinion in in such an enrooted manner as there is here. These meetings are from my perspective a really unusual privilege. And we need simply to continue with it. To continue to develop. There are many ideas for next year, that I will want of course to share with you at the start of the year. If this works for me or not, this is it, only to continue.

The Paris Community is diverse in terms of its members' teaching experience. The instructors navigate the mosaic of the meeting so that it will provide a response to each teacher's unique needs. The contents delivered enable the experienced teachers to refresh and at the same time support the novice teachers. The meetings are held in professional and social cooperation based on support and trust. This is in order to create a feeling of confidence that will allow the novice teachers to ask questions, to posit ideas, and to bring up difficulties. Already after a number of meetings, the novice teachers feel comfortable asking for help and asking questions in physics and pedagogy. They are not afraid that they will appear to the experienced teachers to be incompetent or to have not mastered the learning material. The instructors and the experienced teachers share with the new teachers the practices and ideas for the improvement of the teaching in that they strengthen the feeling of efficacy and self-confidence and help the novice teachers succeed in the first years of teaching.

4.3.2 Difficulties, Dissatisfaction, and Changes Required in the Community

Difficulties, Challenges, and Changes Required in the Community

Among the many positive feedbacks, it was also possible to find criticism. A few teachers were not satisfied with the contents learned in the community and brought up specific topics in which they would like to go in-depth in the next year of activity. It is necessary to remember that the professional learning materials are dictated by the staff of researchers of the Weizmann Institute and the leaders of the community have little flexibility in the second part of the session, in which pedagogical contents identical in all the communities in Israel are conveyed simultaneously.

Criticism, Lack of Satisfaction, and Changes Required in the Community

Criticism of the contents of the sessions and requests for the next year of activity. Material is not covered as planned, conversations on topics related only to some of the teachers, coming to the community despite technical difficulties in the activity times and activity place.

4.3.2.1 Criticism on the Contents of the Sessions and Requests for Change in the Coming School Year

A number of teachers in the Paris Community expressed the desire to carry out a change in the contents and ideas discussed in the sessions. This critical situation provides an opportunity to examine the topic from a positive perspective. The automatic non-acceptance of contents and the aspiration for change necessarily express true interest in the ideas brought up in the sessions. Furthermore, the criticism given on the presented idea raises its status in that it becomes an idea that should be researched (Eschar-Netz & Vedder-Weiss, 2021).

The contents of the second half of the sessions are determined by the developers of the community program, who are scientists and researchers at the Weizmann Institute of Science. Throughout the country, at the exact same time, identical activity is held in communities of physics teachers. In every community, the contents are conveyed, freely,

in a style comfortable for the instructors and according to the character of the teachers in the community. In contrast, the contents of the first half of the encounter are open to the instructors' decisions. It is obvious that when about thirty teachers are present at the session, there will be thirty opinions on the content delivered. Some of the teachers will feel a connection, while others will desire a change. Joe, in the end assignment (2017), in his first year of the community and the first year of teaching, sought to carry out changes and brought up difficulties. He aspired to add to the activity in the next year contents suitable in their nature to a new teacher. "I would be happy if the expert (experienced) teachers in the community would take main topics and demonstrate how they explain them in different ways in order to cover the most of the students' difficulties." His statements display lack of professional experience and the desire to see how an experienced teacher would teach the material. He was interested in observing which strategy an experienced teacher would adopt and which teaching methods. There is here a call for help and a request to focus on specific topics in the new year of activity of the communities. A true desire to experience ways of teaching and approaches of experienced teachers is apparent.

Joe also regretted that the presentation of the teaching techniques was done mostly by Andrei, the community leader. He argues that there is not enough volunteer spirit from other teachers in the community to present sample lessons and teaching strategies. "The one who shared different learning was mainly Andrei. I did not see this from other teachers, and I think that there are different and fascinating things that people do. It is important to hear more the teachers during the meetings, and their different experiences." His words show the favor and appreciation for the experienced teachers and the belief in the vast knowledge they have accumulated. He laments that they are not active enough and it is comfortable for them to listen to the instructor presenting his teaching strategy. This is instead of standing in front of all of them and presenting, participating, and instilling their way of teaching. In other words, it is possible that when writing the summary assignment, he is actually addressing the community instructors, who are reading his remarks. He draws their attention to the fact that the leading teachers perhaps do not provide a sufficient platform for the other teachers. Consequently, they do not initiate the presentation of strategies in front of the class and do not share from their experience. It is possible to see that he believes in the power of the community as a supportive resource that inspires cross-fertilization and

creation of professional discourse. "It is important that the platform that I established on Google for the community will serve as a true instrument for sharing, and not only for the uploading of the presentations from the meetings. It is possible to put up questions for discussion, videos, tasks for performance, surveys, and so on." Joe, as a novice teacher, searches to enliven the interaction with the teachers also outside of the community's hours of activity. He aspires to create a continued platform for the preservation of an ongoing relationship that will operate also between the meetings. In addition, he seeks in the next year of activity to engage specifically in a teaching strategy of the analysis of the students' answers. "To take topics/questions that children have difficulties in and to analyze the difficulty." Joe maintains strongly how meaningful the topic is for him. "As a novice teacher, my constant challenge is how to create a deep understanding among students on topics taught in class. What I have already seen and learned is that each student understands a subject in a different way – through practice, through experiment, through visual display, etc." (End Assignment, 2017).

It is necessary to note that his request is not relevant since in the year of activity prior to Joe's arrival in the community the yearly topic engaged precisely in this field. The teachers analyzed throughout the entire year the students' responses from diagnostic questionnaires and learned to decode the difficulties between the words. The contents in the communities change every year in order to create interest, innovation, and challenge for the expert teachers. While during the discussions and conversations previous contents are used, it is impossible to repeat contents that were already delivered in previous years.

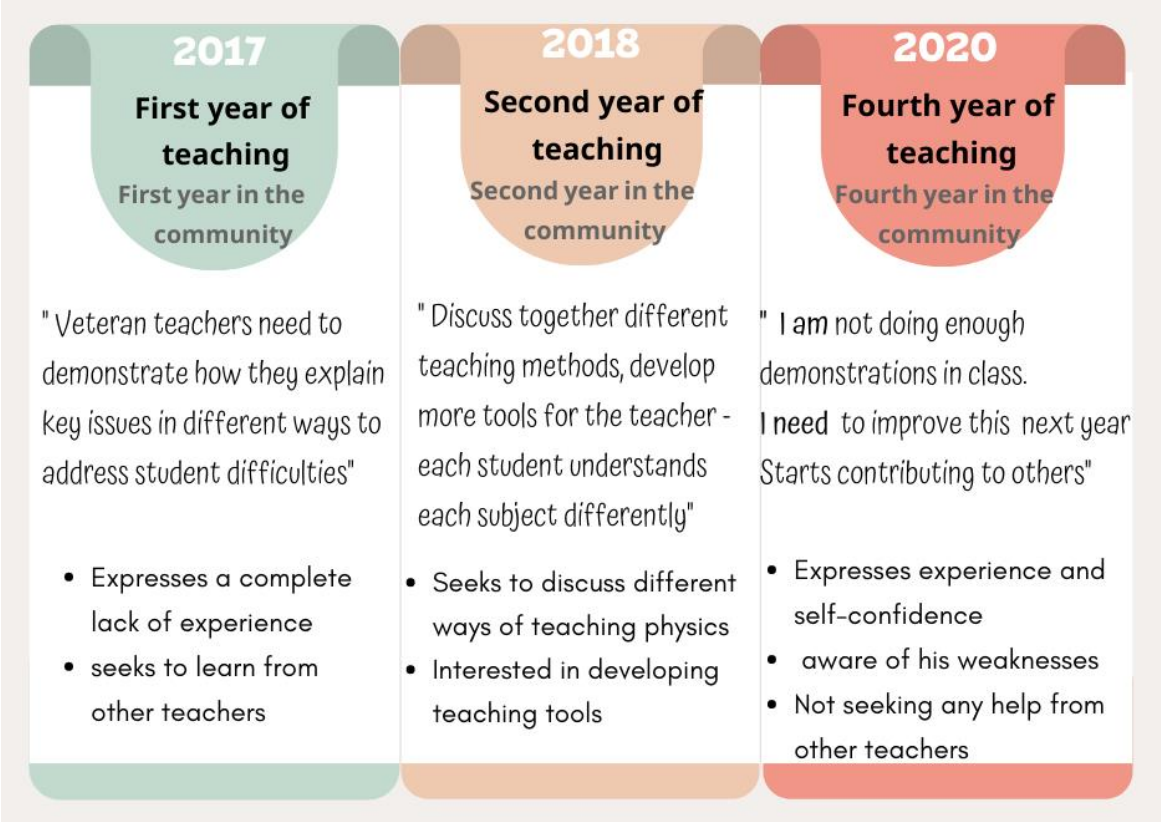
Joe's approach to the teaching of topics in physics by the teachers of the Paris community and not only the instructors softened a year later. In the End Assignment (2018), it appears that he is already satisfied with the teachers' contribution: "In the community there is the sharing of knowledge and experiences that enrich me and produce thoughts what can be strengthened and what can be preserved." It is possible to attribute this sentence specifically to his fellow teachers and not to the leaders since in his following remarks he refers directly to Andrei, the community instructor. "Since I am a novice teacher, every new experiment that Andrei proposes, every video, or every professional dilemma is an asset for me and true learning." The requests for change of contents also changed after the year of activity. It is possible that he found a solution to his requests or grew and developed during the year and his needs changed. "In my opinion, it is necessary to talk more about different ways of

conveying the material – every student understands differently every topic and it is necessary to develop more tools for the teacher." Two years later in the End Assignment (2020) there was no request for any change in the community and it appeared that the criticism of the community became self-criticism. "I am exposed in the community to many demonstrations and toys that enthuse me and stimulate thinking – I do not manage to do demonstrations, and I must improve this issue next year." It is clear that the professional confidence, sense of efficacy, and self-esteem have strengthened. "I think that I am beginning to contribute from my experience also to others, and I learn every day how to become a better teacher."

Joe began his way in teaching and in the Paris Community with the existential need to observe how other teachers teach and thus to learn from their experience. During the three years, Joe developed from a new teacher who depends on his peers to a teacher who knows his abilities and is aware of what he can contribute to the members of the Paris Community. The organizational culture in the Paris Community, in which the teachers discuss together the building of collective knowledge, leads to meaningful professional development. The community teachers invest in their learning and in the research of teaching and thus meet the students' needs and improve their learning.

Process of Joe's Change of Approach regarding the Professional Experience He Accumulates

Figure Number 21: The Development of Joe's Professional Self-Confidence



Oliver, a teacher in his third year in the community and in teaching, seeks to learn in the meetings physics contents and not only teaching strategies. When a teacher is expert in the theoretical material, in physics, he understands in-depth the meaning of the formulas and not only the technical use of them. This insight of the teacher has considerable influence on his way of teaching and his students' learning. Oliver brings up a number of issues in the End Assignment (2016) that address the changes required in his opinion in the community. "I would be happy if a larger part of the activity in the community would be really dedicated to the advancement of the physics knowledge in topics relate to the curriculum – for instance the sharpening of the problematic concepts or solving more difficult problems (for instance, problems taken from the Physics Olympics)." Oliver feels a need to strengthen the professional knowledge and is less bothered by the pedagogical knowledge. This

phenomenon is known by teachers at the start of their path. They are more afraid of the learning material and less of the teaching method. A considerable time in the preparation of the lesson is dedicated to coping with the theory of solving of exercise and sometimes they do not understand in-depth complex topics and do not succeed in solving exercises on a high level. Oliver noted the Olympics questions, which are especially complex questions presented in the framework of the time period found only in the Paris Community – 'Olympics time'. Andrei the instructor is a part of the professional team where the questions for the national Physics Olympics are composed. and he presents to the community teachers, in every meeting, another question. The teachers are given time to think for themselves, then discuss the question in small groups, and last discuss the question in the plenum, when Andrei describes the ways of solution. There is in-depth study in physics, in the theoretical material that addresses the more complicated concepts that are not included in the curriculum. However, to better master the learning material, a teacher is required to know also contents beyond the curriculum since their understanding creates a better understanding of the topic in general.

His second request for change of the contents in the Paris Community derives also from the very fact that he is a novice teacher who does not know how an assessment rubric in the high school matriculation examination is built. The rubric determines how the points are divided in every exercise and presents the criteria for every level of answer and what points are docked for. Thus, the teacher can emphasize for his students in what they are required to be meticulous during the solving of the exercise in order not to lose points in the test. "I would recommend using the community meetings in order to discuss the official rubrics of the high school matriculation examination questions." He explains the rationale for his request. "This is in order to help the teachers better understand the emphases required in the phrasing of the answers to the high school matriculation examinations. For example, how is the score determined in an answer for a literacy question." It is necessary to note that all the experienced teachers find this topic to be important and the community meeting that engages in the rubric is generally marked by turbulent discussions and raised voices. Sometimes teachers do not agree with the decision of the professional supervision to take off points or a professional argument develops when at its end the teachers better understand what is required of them.

Oliver's second request for the change of the activity that comes in the Paris Community was scheduling the learning in the community for teaching in the class. "I would recommend to try (as much as possible) to synchronize the topics that the community addresses, to integrate in it this topic learned [in actuality] in the classroom." He recognizes the limits of the ability to schedule and the limits of the flexibility of the community but shares his aspirations for the desired change. "It is clear that it is not possible to achieve perfect synchronization, especially when in different age groups we learn different topics." Oliver continues to describe his desires: "As there will be greater synchronization it will be more convenient to implement ideas and insights from the community into the lessons in the classes." (End Assignment, 2016). This is a constructive comment and not a critical comment. The teachers are very satisfied when they leave a meeting with a worksheet, video, or activity that suits them exactly "tomorrow in the morning" to present in the class. They also note in the feedback that this is one of the strengths of the community, to provide actual materials for the use in the classroom after the community meeting.

The academic backing of the Weizmann Institute in combination with the leading teachers identifies the pedagogical needs that arise from the communities. Then what forms is a training program with the goal of interesting all the members of the PLC and not the specific population. Clarification of the needs is done from listening, attention, and display of sensitivity in order to be precise with the contents coming to the community. Frequently despite the early preparation a gap is created between the planning of the meeting and what happens in actuality. This change is caused in most cases following the experience of the community leaders to be as precise as possible with the teachers' current needs. The instructors are flexible and spontaneously change the meeting program to provide a solution for the need that will arise suddenly. To provide an incentive for the teachers to try the new teaching materials, it is necessary to build them so that they will be ready to use immediately and relevant for the same week. At the Weizmann Institute they work on the diversification of the materials so that they will suit the high school teachers who teach at different age groups. In addition, the teaching materials must engage in the curriculum, and it is necessary to present them with the correct timing and not after they have already been learned.

4.3.2.1 Material Is Not Covered as Planned

Every PLC session is composed of two parts. The first half addresses activities dedicated to the daily needs of teachers. The teachers share ideas and are exposed to the physics use of a toy, video, or thought-provoking experiment. The second half deals with the in-depth processes of learning and learner-focused approaches to the teaching of physics (Eylon et al., 2020). The success of the pedagogical conversation, the learning, and the reflective research depend on the teachers' sharing. Hence, it is necessary that all community members have an active part in the second half and share the success / failure after the delivering of the activity in the class. The leaders need to direct the teachers from the part of the building of the community in the allotted time so that they can focus on the part of the students' learning.

It is very important to preserve the balance between the first part that strengthens the social relationships between the teachers and the second part, the academic part, in which the focus is placed on the relationships between teaching and learning. When the social part slips into the theoretical part, some of the teachers may feel they are missing out because the meeting does not have enough benefit. However, it is not easy to manage an intensive and full year of activity without slipping in times. In the Paris Community there were a number of meetings in which the boundary between the two parts of the meeting was not maintained. Joe and David noted the feeling of missing out and wasting time in their responses to the questionnaire on the coordination of expectations. At the end of the last meeting (2018), all the teachers were asked which contents conveyed to the community helped them in the diversification of the teaching. Joe answered that in his opinion there were no such contents. For the question, 'does the conversation in the community on the teaching of physics contribute to you?', Joe answered: "Only if the conversation becomes more focused." For the question 'did the participation in the Paris Community meet your expectations?", David answered: "Largely, yes. Although it is always possible to derive more. But the atmosphere is good, and if I want something, then I feel comfortable asking." Joe and David are novice teachers who express in their sharp responses a need for the continuation of their training. They search for frameworks of mentoring and support that will accompany the processes of change and growth. They see in the Paris Community a direct

continuation of the training they experienced in the academic institutions. Already at the start of their new path in teaching they begin to build their perceptions and teaching strategies. They are aware of the need to be up-to-date and to learn methodically year after year as a part of their professional development. The cooperative learning in the Paris Community among experienced teachers enables them to get to know different teaching perceptions. The communality produces a wider basis of knowledge than the knowledge that each one can learn by himself with his class. In their opinion, every moment in the academic part should be exploited for learning and it is necessary to respect the allocated time. From their perspective, complaints, and chatter take away from the learning and the material is not covered as planned.

The academic part should be utilized for learning, and it is necessary to respect the allotted time. From their perspective, sometimes there are differences of opinion, misalignments, and minor social conflicts among the members of the Paris Community. It becomes clear that even expert teachers seek to leave with something new in every meeting and are angry when this is denied them because of a dispute in the community. In Meeting 3 (2016), there was an argument between two teachers that extended and delayed the academic part. Emily commented to both of them that they are in an idle discussion and then turned to me with impatiently. "So, when are we moving on, I do not have the patience to wait for them to stop talking." The following meeting, meeting 4, engaged in teaching methods in which the discussion went out of control and extended far beyond the planned time. Consequently, we did not manage to finish the learning of the part, the academic part. The teachers expressed disappointment from the fact that the material was not covered as planned. Some of them did not give up and remained with the leaders after the end hours of the community. Other teachers, who could not stay, entreated the instructors to continue next time the same topic, which they found to be important and essential.

The Paris Community combines between academia (the Weizmann Institute) and teaching physics in the classroom. The positive tension between these two poles is expressed in the planning of the meeting and the general organization. On the one hand, it is not possible to give up the times of the sharing of experiences, emotions, and ideas, since this is how the community is built, in which there is true friendship and a sense of

partnership on the way. However, it is not possible to give up the part of the reflective cooperative learning. This half of the meeting is filled with innovative and meaningful contents direct from the research world. The correct mix and effective time organization between the two halves is what creates the feeling with which the teachers go to the meeting, the feeling of missing out or not covering the material as planned or the new instruments for tomorrow morning in the class.

A number of teachers complained that sometimes the first half of the meeting is extended and the time remaining for the second half that addresses the professional contents does not allow the topic to be fully finished. It should be noted that the community leaders allow everyone to continue with activity also after the end time of meeting. They always remain to answer questions that arise in the first or second half of the meeting, to help with technical things, to answer personal questions, to solve a complicated exercise that the teacher did not succeed, and so on. If we remember that the community teachers come at 16:00 after a full and long work day, it is possible to understand that most of them want to finish on time and to return home at 20:00. However, there are always teachers who remain to ask questions and thus the leaders do not leave the meeting before 21:00.

Many of the teachers noted that they see the community meeting also as a social meeting and enjoy the conversations with colleagues – but not all of them. Joe, in his second year in the community and in teaching, wrote after the first meeting. "The round of getting to know one another and side conversations was too long. I am interested that we begin to talk about the students' difficulties and about creative ways to explain complex topics from the curriculum." (Expectations at the End of the First Meeting, 2017). Joe emphasizes in his words that the meeting was not effective for him. He did not manage to learn all the material planned following a deviation in time. It is interesting that the rest of the responses after the first meeting were different. Nina wrote: "The round of getting to know new friends: it was interesting to know and hear what is new in the different schools." Alina, a very experienced teacher about to retire, even wrote: "A most moving first meeting. Excellent food. As usual ideas for performance. Well done." Her response and Nina's response are completely contradictory to Joe's feelings. The first meeting of the community was held after a break of four months. Most of the teachers came at four o'clock, but Alina was late and when she

entered the room all the teachers rose for her and hugged her and were interested in how she is. She was very moved by the welcome. She told that at home nobody comes to her when she goes through the door, aside from her dog, and here everybody rose to hug her. It is possible to read responses from both sides of the scale about the first meeting. The majority are satisfied by some are not, but this is how it is apparently in a community with a variety of people and a variety of opinions. The mutual esteem despite the great difficulty that exists between the Paris Community teachers creates an inclusive and flexible culture of conciliation that enables learning despite everything.

4.3.2.3 Conversations on Topics Related Only to Some of the Teachers

The collegiality between the members of a professional community as senior and strong as the Paris Community may sometimes be a disadvantage. One reason is the case in which only some of the teachers share conversations and for other teachers the topics is not relevant. Another reason is conversations that do not advance professionally but only reflect a search for comfort and a shared fate. Relationships, conversations, and cooperation between professionals are considered generally a positive trait that should be cultivated and mainly in PLCs. However, when in actuality this is the sharing of complaints and stories, this interaction worsens the atmosphere and does not cultivate the teaching. In this case, the strong relationships between the teachers create collegiality that inhibits the learning instead of challenging and developing it (Hayton & Spillane, 2008).

Joe, as a new teacher and a single teacher in his schools, needs every moment of learning in the community meeting. When the conversations revolve around marginal topics or topics not related to the teaching of physics, he quickly stops the discussion. In Meeting 7 (2017), he turned to a group of teachers who come from the same city and address problems in teaching physics that arise in their city. The topic is charged and creates arguments and raised voices among the teachers. This group generally begins its discussions around the dining table, before the meeting, and continues the argument also in the breaks. Sometimes these private conversations extend beyond the break, into the time of the academic part of the meeting. Joe argued to them that "the topics of the conversation need to be shared by the entire community." From the perspective of the leader of

the Paris Community, it is possible to see a large and cohesive group of teachers who come from one city naturally discussing their specific problems. They gather together for an internal discussion that does not interest the other teachers since it is not relevant to them. Consequently, the group is large and vocal and the conversations extend beyond the conversations around the dining table and the entire community is exposed to them. Joe turned to the community leaders in an aggressive tone that was also directed at the group of teachers: "It is not interesting to hear every meeting about their troubles, they go past the break and this learning time is wasted." There is truth in his words, since the conversations in the hallway and conversations around the dining table are supposed to end when the activity begins, but when there is a large and noisy group sometimes it is difficult for the instructors to bring them back to the planned learning and they continue with the conversations also during the shared learning time, in parallel to the instructors' statements, and unquiet is created in the room. Ilya, a novice teacher, also addressed this topic, and his feelings are identical: "A large core of the community (from the same city) has been together for already a number of years and we felt a little like outsiders. In my opinion, there is more room to hear and make heard the new people. A lot of time is dedicated to the problems of these teachers in their city, this is a painful topic but it does not pertain to everyone, and in my opinion it is a pity that it comes up all the time." (End Assignment, 2017).

The discussions between the teachers of the Paris Community are effective, meaningful, developing, and challenging. The interactions enable knowledge and new resources with in-depth pedagogical discussion to be acquired also in the recesses. The community leaders are responsible to find the balance between the time of personal conversations and the time of sharing learning. In addition, they are required to ascertain that all the community members will play an active part in the meetings and will share in their activities in the class, difficulties, and dilemmas. The senior teachers come to the Paris Community year after year in a continuous and regular learning routine. Infrastructure, tradition, and a shared language are created between the teachers in the learning time and in the recess time. Sometimes new teachers are deterred by the closeness and do not participate in the conversations, and attention and sensitivity are required on the part of the experienced teachers and instructors. The interaction during the recess and around the dining table is very important, before the meeting. This is the place where members of the

Paris Community talk freely about the topics close to their heart. Sometimes the discussion addresses the contents of the previous meeting and its degree of success in the classroom. These informal meetings strengthen the interpersonal relationships between them and contribute to the creation of relations of closeness and trust in the community, and thus everyone develops professionally.

4.3.2.4 Lack of Satisfaction

In the Paris Community there is a broad range of types of teachers. Some teachers tend to argue about every topic that comes up, while other teachers tend towards forgiveness. The community is a heterogeneous group for learning and work that has methodical and orderly learning through multiple interactions between the members. However, it appears that sometimes the desire for heterogeneity versus the difference between the teachers causes lack of satisfaction among some of them. The teachers' interactions with one another influence their practice (Hayton & Spillane, 2008). Therefore, to advance processes of teaching and practice, the instructors need to create an atmosphere of satisfaction among all the participants in the meeting.

Like in every in-service training, there is always criticism about the running of the meeting, the community instructors, and the colleagues. The teachers meet every two weeks, feel great closeness, and allow themselves to vent and complain together. Part of the feeling of family is the ability to share difficulties and sometimes also to grumble. The professional fraternity allows complaining about the orders from above from the supervision of the teaching of physics and expression of criticism on the running of the school and on the decisions of the principal or the Ministry of Education. The teachers expressed great dissatisfaction with the changes in the composition of the high school matriculation examination, and sometimes the tone was sharp and cynical. It is possible to understand from Ilya's words that he does not like this tone in some of the conversations – the conversations in the hallway, the conversations around the dining table, and sometimes the cynical comments said during the activity. "I do not like hearing teachers who only grumble, in my opinion, the time and the resources should be directed to more positive channels. I would like to have more activities in which we are active and creative – like the marshmallow challenge. Also more discussions on physics and less on what will be on the high school

matriculation examination, etc. (Expectations at the End of the First Meeting, 2017). The atmosphere and the conduct in the meeting are what create the sense of satisfaction or lack of satisfaction with the community. Some teachers prefer to receive tools and teaching practices and less ask for sharing and including. It is possible to see in Joe's words at the end of the same year of activity that he also shares Ilya's opinions. He sees a meeting that engages in technical issues and expression of emotions to be unnecessary since the community time is not utilized. "In my opinion, we wasted time on marginal things like grumbling and technical issues." (Feedback at the End of the Year of Activity, 2017). Ilya's and Joe's lack of satisfaction in this case derives from the inclusive atmosphere that is created among the members of the Paris Community. One of the goals of the PLC is to create social relationships in order to be exposed to new ideas. The sharing that is performed in the hallway conversations with colleagues enables self-expression and shapes the professional approach but sometimes extends into less desired places.

Sometimes dissatisfaction is with the learned contents. In Meeting 9 (2018) we performed an activity on the topic of a thought-provoking laboratory. In this format, the students do not receive an orderly briefing as with a traditional experiment but are asked to invent the topic of research according to the equipment at their disposal. The teachers experienced as learners this challenging activity and at first expressed their displeasure and were not at all satisfied. They did not cooperate, they maintained that they do not know what to do with the equipment, and they asked the community leaders to solve the assignment for them. As aforementioned, the meeting contents are determined by the staff of the Weizmann Institute, and they are set for all the communities around the country. Therefore, the instructors are not flexible but attempt assertively to return the teachers to the learning track despite their dissatisfaction. At the end of this activity in which all the teachers participated, without exception, everyone praised the activity. The teachers of the Paris Community were forced to leave their comfort zone and challenge themselves and proved that it is hard for them to change habits.

Other times the dissatisfaction derives from the conduct of the meeting itself. Teachers are angry and do not notice when the tones rise higher than acceptable. In Meeting 2 (2016), the academic part addressed the definitions and concepts. There was an argument

between the teachers that reached high decibels. One teacher asked, Andrei attempted to answer, but many teachers broke into his words and attempted to express their opinion and respond in his place. The result was noise and confusion, and nobody in essence listened to another's words. There were a number of minutes in which teachers engaged in arguments only with the teacher sitting beside them. It was difficult to calm things down and return to the discussion and the atmosphere was heated. At the end of the meeting, Rose admitted that this part of the meeting was for her "loud and vulgar. She did not enjoy at all and hopes this is a one-time case." The goal of the discussions in the Paris Community is to provide the teachers with the possibility of clarifying their attitudes after exposure to new ideas. This is an opportunity to have professional negotiations with the peers, to ask questions, and thus to shape the approach to teaching and the understanding of the new idea. However, sometimes part of the inclusion of new ideas creates deliberations, anger, and lack of satisfaction.

Emily displayed lack of patience and lack of satisfaction in Meeting 3 (2018) during the theoretical explanation. The researcher stopped the explanation following the great noise of the community teachers. Emily turned to her with the use of an impatient expression. "Nu, nu, move ahead."

When she saw that the noise did not stop and the explanation stopped, she turned to the community of teachers with a louder than usual voice and in an angry tone: "Let there be quiet here." There was an unpleasant atmosphere for a number of minutes, but the community learned to include also the angers of Emily and no teacher responded. Another case of dissatisfaction occurred after a number of months, in Meeting 8 (2018). In the academic part they engaged in formulas that are not in the curriculum, and a suggestion was made to skip the stage of the proof. Max exploded and maintained angrily that it is forbidden to make things easier for the students and posited exhausting math and physics arguments. There were many objections to his words, and Emily raised her voice and yelled to him that he "is interfering with the leaders' teaching". Max was insulted, left the room, and said: "I am going. If I go, then it won't be messy." The lesson was cut short, the instructors attempted to convince him to return, but he refused and left. The atmosphere was miserable. Nobody commented to the teacher who had yelled, but she herself felt uncomfortable and

apologized. Sometimes a teacher who is not satisfied with the meeting expresses himself aggressively and may insult another member of the community. The community leaders must avoid the repetition of such cases that create dissatisfaction among the teachers. The main objective of the community is collaborative learning, and the teachers need to adjust and include the range of opinions and types.

Another event in which Max felt dissatisfaction occurred in Meeting 4 (2017) during the assembly. In the informal conversations around the dining table, a discussion of many participants developed. Max attempted to express his opinion but his voice was silenced by others who spoke in parallel to him. It was not possible to understand his words, and he tried again and again to respond, but all the teachers were talking at the same time. The discussion was at a low tone, but the fluent conversation did not allow him to express himself and he muttered: "They don't let me talk." After about an hour, in the academic part, Andrei explained the theory of the new activity. Max added a long and confusing theoretical explanation that caused most of the teachers to stop listening and to talk among themselves. He appeared to be disappointed and shared that "he taught in Russia for many years and in every place they respected him and listened to him." He maintained that he is attempting to teach the Paris community teachers physics theory but "he feels that everyone is bored when he is talking." It is necessary to admit that there is some truth in his words. He speaks in a monotonous tone, and with flawed Hebrew that is difficult to understand. In addition, his explanations are long and tend to be exhausting with complicated physics formulas. All these difficulties cause most of the teachers to lose attention already at the start of the explanation. Max left the meeting disappointed and feeling prominent dissatisfaction. This event illustrates the less pleasant side of a single teacher in a large community. Sometimes the shared conversation between many teachers may cause some of them to remain outside of the discussion and leave the meeting with a feeling of dissatisfaction. During the discussions, it is important to allow every teacher to express himself and express his opinion freely. If the teachers of the Paris Community do not feel that their peers appreciate their opinion, then they will avoid sharing their knowledge and ideas and cooperation will not be created.

Dissatisfaction from the access to the meeting materials and the presented contents is heard also in the words of Joe and Victor. They are both novice teachers with technological skills that lead innovative pedagogy through the use of an online environment. Joe developed an Internet learning platform for his students and for the Paris Community. He brings up to the environment the contents conveyed in the meeting but is not satisfied with the accessibility to materials. "Very beneficial summaries of the learning material in the high school were presented. The presentation will be effective if the materials are delivered to us." (End Assignment, 2017). It is possible to understand that Joe would like to obtain the materials presented in the meeting and to process them at his pace and in a format suited to him. At the end of every meeting, the community members are sent the presentation that accompanied the meeting with links to videos and relevant activities. During the discussions the teachers associatively recall videos that were presented in the community and discuss them. Contents that were not planned but are relevant to the conversation in the community are brought up. The spontaneous additions are not accessible to the teachers since they are not written in the original presentation. Joe is not satisfied with the accessibility of the material, does not include spontaneous change, and finds it hard to be flexible on the issue.

Victor expresses dissatisfaction with the teaching materials and is interested in receiving other contents than those offered by the Weizmann Institute. He brought up topics that were not in the program of the communities such as the independent learner. "While we spoke much about means of demonstration, illustration, and explanation, we touched less on ways in which the students will be active and will achieve independent learning." It should be noted that he not only complains but also proposes ways of improvement. "It appears to me to be important to focus in the future on ways to have the students act both in solving and independent theoretical understanding and in performance through research of a range of experiments and demonstrations, when a larger part of the learning goes through independent learning." (End Assignment, 2017). The aim of the community is to introduce changes in the teachers' ways of teaching and to take them from the familiar and comfortable area to a contemporary field of activity suited to the students. The novice teachers like Joe and Victor less support traditional teaching methods and are more flexible and open to changes but still display lack of satisfaction with the contents.

In every community there are experienced teachers, those who joined only this year, and also those who are trained for teaching from the fields of hi-tech. in other words, in the community there are teachers for whom this is their first year, second year, third year, … and it is a challenge to provide a response to all. There is the heterogeneity of teachers in the community: heterogeneity in the teaching experience, in the community experience, in the needs, in the preferences, and in the preferences and who they are. In the Paris Community there is the activity of processes of adjustment to the different work patterns, getting to know different teaching perceptions, and this from compromise, concession, and adjustment. The exposure to a range of opinions and ideas is supposed to empower the pedagogical abilities, but some shy away from the communication, abundance, and inundation. To lead a change in teaching, the teachers need a community meeting in which they can ask, deliberate, include, and even be angry sometimes that they are not satisfied.

4.3.2.5 Coming to the Community despite Technical Difficulties in the Activity Times and Activity Place

The community requires the teachers to come after the work day in the school, to invest time and effort, and to remain to learn until night. It is difficult to participate in the PLC and also in the mandatory school activity, and therefore teachers leave and return, but there is always a basis of regular teachers in the Paris Community. In a culture of collaborative professionalism, all the teachers participate in the learning activity in the community in order to develop and to grow. In this positive approach, they do not see the coming to the community meetings to be another assignment in their busy daily routine but to be a vital need.

Physics teachers in the PLC are active learners who shape their professional growth through reflective participation in a program for professional development. Every teacher is an independent learner who comes with his professional experience to the collaborative community that serves as a supportive and productive learning environment (Levy et al., 2021). The teachers consider the legitimate difficulty in coming to the community versus the benefit obtained in the collaborative encounter. In most cases, the scales tilt in the direction of the advancement of the teaching and personal growth, and as proof, the number

of teachers increased every year. The professional development is perceived in their eyes as a means of the improvement of the learning experience and the students' achievements and overcomes the technical difficulties of the long journeys in the hours of the night. A teacher in his first years of teaching who came for the first time to the Paris community noted that in the past he belonged to a different community. The travels there lasted more than an hour in each direction, and therefore he decided for reasons of proximity to come to us. He chose to change the PLC in favor of shorter travel time and justified the change. "I learned a lot, but I felt that I am investing a lot of time on the roads." (Felix, End Assignment, 2017). Another teacher, also in his first years of teaching, experienced two years in another community and said: "I began this year the Paris community and I discovered a community full of life, which despite its distance from the residence [of most of the participants] attracts to it many teachers (it appears that it is the largest community)." (Arthur, End Assignment, 2017)

The meetings in the community begin at around 16:00, and many of the teachers in the high school work until the late hours and come to the community meeting directly from the last lesson in the school. Phillip, an experienced teacher, in his first year in the community asserted: "In my opinion, it is necessary to change the hours. It is very intensive to return from the school day and to come directly to a meeting but I know that there apparently is no solution for this." (End Assignment, 2016). One of the ways to make it easier for the teachers who come tired and hungry from the work day directly to the beginning of the study day in the community is the dining table full of good things waiting for them and open throughout all the hours of the meeting. The meeting ends in the evening hours, after about four hours of activity. A late start will cause it to end late, and then it is necessary to drive home late at night, and therefore it is not possible to change the times.

Phillip, Anton, Oliver, Harry, and other teachers come to the community from a distance of 50 minutes away in each direction. Anton wrote about this: "I enjoyed and I learned a lot from my participation in the community of physics teachers in Paris during this year. I come from far away and the trip is not short, but this is more than worth it in my opinion and I intend to participate also next year in the community." (End Assignment, 2019). It is apparent from his words that despite the distance, the advantages in participation in the community surmount the technical difficulties. Similar things were written by Harry, who could have

participated in a community in an area closer to his home. "Although I do not live in the region of Paris and I could have participated in another community in my region, when in terms of the distance they are closer to my residence and also to the area where the school I teach is found, I continue to come regularly to the community in Paris and this is because of the instructors of the community – Andrei and Daphne." (End Assignment, 2019). Harry attributes the continuation of his coming to the community despite the distance to his fondness for the community leaders. Oliver also complains a little about the hours but praises the advantages. "Despite the distance of nearly an hour of travel in every direction and although the community meetings were held after a busy day at school, I waited once every two weeks for these meetings. The community members – physics teachers – in part expert and experienced teachers and in part with even less experience than me – constitute an integration of a social framework and a professional framework." (End Assignment, 2018).

It is clear that the face-to-face meetings of the Paris Community are important to Oliver and justify the effort of coming from a distance and spending a long time on the roads. He told colleagues in the 'Points of Light' Time in Meeting 6 (2018) that he came to a meeting while sick. "I was sick 3 days, I did not go to the school to teach, but I had to come to the community." This sentence indicates more than anything how much he sees the need to meet with his peers despite his illness. The sacrifice in coming sick to the meeting with the colleagues was stronger than the effort required in teaching the students in the class. Sophia, a novice teacher, answered him that she too: "does not miss a single meeting". She explained that she feels that she builds in the Paris Community her professional backbone. She shared with everyone the difficulty she experienced when her husband needed to remain with their two little children. She also noted how it is not simple for her: "To be absent until the night after a full day of work at the end of which there is the in-service training." But despite everything she continues to come since "she feels that the professional benefit outweighs her personal issues at home."

In the continuation of the discussion (Meeting 6, 2018), Karina, an expert teacher, noted that the meeting with colleagues in the Paris Community face-to-face is for her mental support in the teaching process, and therefore she continues to come year after year despite the distance. Sophia returned to the difficulties of coming to the meeting and answered her that she has a baby and it is rather hard for her to leave home in the evening

hours and come to the community, but at the end of every meeting she tells herself: "it was worth it." Sophia shared the benefit she feels in coming to the community, despite the inconvenient hour and summarized that coming to the community is worthwhile and therefore she continues to come regularly. Rose turned to them and shared that she too comes from far away and she in essence is the farthest from Paris. She added that, "She benefited professionally but also socially and gained for herself new friends who are not only professional colleagues but also real friends. They meet together also outside of the community hours and host one another in their homes." These social relationships that are created from the shared professional engagement are possible only after people get to know one another well. For this, many meetings, held face-to-face, are needed, to create trust, an honest friendship, and reciprocal support. In the Paris Community personal learning processes develop, and in this also a true and in-depth acquaintance between the teachers and between the teachers and the community leaders is created. This acquaintance enables the development of relations of trust and confidence in their fellows in the group – for professional deliberation, personal disclosure, mutual holding, closeness that is almost familial. The listening and observation in the learning process becomes the way in which the teachers build their day professionally.

Gregory, an expert teacher, who has taught for more than 40 years, joined the Paris community in 2018 although he does not live in the area. At the end of a productive activity that addressed a diagnostic question (Meeting 1, 2018), he said: "I think that I missed much when I did not come to here in all these years of the community. I always had excuses, why I did not have the time to come. The loss is completely mine." He was proud of the fact that he is very knowledgeable in physics and teaches the students by heart without a book. He thought that because of the great experience: "there is nothing left to learn." He noted that he greatly enjoys the learning in the Paris Community and the sharing of the other teachers and said that only now does he feel how much he can be renewed in teaching since he has taught in the same way for many years without any diversification and he began to bore even himself. Coming to the community despite the distance appears to him to be important. He is interested in advancing the teaching of physics and is aware that every change in the class must begin with a change in the teacher. The face-to-face meeting with the other teachers allows him to undergo meaningful learning processes and to bring from

himself and himself with the colleagues. The teachers note in all the feedback that the important part in the Paris Community meetings is the interaction with the colleagues. The conversations during the recesses and during the shared learning are what create the community experience, and therefore a face-to-face meeting is required. Some of the Paris Community teachers noted that they live far away and the travel takes a long time and is at a late hour. The deliberation is between the benefit of the community meetings and the price paid in these trips.

5. Discussion and Conclusions

The objective of this research study was to examine the learning characteristics of the physics teachers learning communities from the perspective of the teachers participating in the Paris Community. The research study attempted to identify the reciprocal relationships between the contents, the process, and their implications on the nature of the learning created in the community of learners. The research also endeavored to illuminate the issue of the dependence between the learning and the change that the interaction in the community sparks and the consistency between the learning in the community and the nature of its expressions in the teaching in the classroom.

The research population included 26 teachers who participated in a professional training program that focused on the promotion of knowledge in physics and in teaching physics, in the framework of the "Professional Learning Teacher Communities Close to Home" Project. The research examined the process that led to a change of the content knowledge of teachers in the Paris Community in the years 2016-2020 and the influence of the promotion of the teachers' knowledge on the students' learning.

To examine these relationships, a number of central questions pertaining to the community's disciplinary characteristics and the contribution to the teacher and his students were examined. Interviews, feedback, and observations collected during the four years of research were analyzed with reference to the main insights that arose from the chapters of the findings.

The discussion in this chapter is focused on providing an answer to the four research questions, as arising from the chapter of the findings and presented in separate subchapters. For every research question, we present the findings and we address in the discussion the previous research findings and insights from the research literature. In the continuation of the chapter, we address the research contribution, the applied implications in teaching, the research limitations, and the recommendations for future research.

The research questions at the heart of the present research study are as follows:

1. What are the perceptions of the physics teachers and what is their attitude towards the participation in professional learning communities?
2. What is the contribution of the professional community to changes in contents and ways of teaching that occur among the physics teachers?
3. What in the teacher's opinion are the causes of effectiveness of the professional physics community?
4. Did the change that occurred in the teacher following his participation in the community create a change in the students' learning?

The present chapter presents the picture delineated by the research study regarding each one of these questions, as well as the research conclusions.

In the research methodology in the present research study, the research instruments were texts, interviews, and observations that occurred in the natural environment of the community. The analysis of the data in this qualitative research was in the method of thematic analysis, which focuses on what the research respondents say and explain. This method addresses their words as reflecting their emotions, experiences, and knowledge. The analysis was carried out in a process of ordering and structuring the collected information and entailed the division of the information into parts and the organization of the parts in a renewed analytical order. After the division into categories, the data was examined according to models in the research literature and the relationship was identified between the data and their theoretical translation (Shkedi, 2003). From the translation of the categories that grew from the data into theoretical interpretations, a "grounded theory" was built about the world of the teachers in the community regarding the three groups of concepts: professional development, teaching approaches, and the changes that occurred in the class.

5.1 What Are the Physics Teachers' Perceptions and What Is Their Attitude towards the Participation in the Professional Learning Communities?

Insights on the Teachers' Attitudes and Perceptions of Participation in the Physics Professional Learning Community

The physics teachers' perception of their participation in the learning community reflects their beliefs and values about professional development. Their attitude represents their teaching approach in actuality and the appropriate teaching approach in their opinion. Their perceptions address mainly the questions, such as how should certain topics be taught? How should the students learn? (Gilad, 2001; Little, 2002).

The research question was: *What are the perceptions of the physics teachers and what is their attitude towards the participation in the professional learning communities?*

In most of the findings, the perceptions are not characterized by clear formulations but rather thoughts on teaching, insights on the students' learning, and prior knowledge on the students' attitude towards physics. As aforementioned, in the research study the community is very diverse and is composed of experienced teachers as well as new teachers. The findings indicate that the community teachers, regardless of their experience level, teach and learn without "ego" and with an abundance of humility and desire to experience their teaching and their students' learning. As a result, over the years a strong community was built, which became a meaningful factor for assistance for new teachers and for cross-fertilization of the experienced teachers. Learning through constant and continuous support establishes the professional growth (Bryk et al., 1999). The definition of a professional learning community is as a meeting of teachers who are interested in examining in a methodical manner their practice and professional knowledge in order to improve their ways of teaching (Borko, 2004; McLaughlin & Talbert, 2001; Waldman & Blonder, 2020). In actuality, the findings indicate that the teachers when they come to the physics community are characterized as full of desire to improve. The community meetings are held as a friendly and warm meeting of work colleagues, with attention to the issues and challenges of the participant teachers. The data can facilitate the explanation of the teachers' feeling that they have "come home". They all reported that they can share without

fear their needs and the challenges that trouble them. The teachers' attitudes in action are commensurate with the theory declared by the thinkers of the project of the community, as indicated, to a certain degree, by the research findings (Kim et al., 2012; Lieberman & Pointer, 2009).

The review of the literature presented that the need to establish the communities arose from the field. The physics teachers are generally alone in their school and *through the community in essence a team is created on the regional level* (Eylon & Bagno, 1997; Eylon et al., 2008). The data confirm that the teachers feel in the school like a lone wolf, without a colleague who can be of assistance. The answer is the community meeting that links with other teachers, who are partners in the same field, and thus cross-fertilization and exchange of information are possible. Moreover, it is clear that over the years the community meetings have become social meetings and not only professional meetings and the teachers anticipate coming, being refreshed, and meeting with people in whose company they enjoy being. This finding is commensurate with research studies on the feeling of the physics teachers as a lone wolf who is forced to work alone and not as a part of a group (Cohen-Brenner, 2017). The PLC provides, therefore, an answer to the special difficulties of teaching physics in which in most cases a single teacher is teaching, without a colleague to provide advice and support (Etkina et al., 2017), and the community for the teachers is a place for meeting professional colleagues for the purpose of renewal, growth, and cooperation.

The examination of the processes of the professional development of the research participants, which are mainly the creation of professional relationships with colleagues, indicates that the social relationships created are important for them no less. *The teachers noted that the community enables the exchanges of information and that the interaction with teachers from other schools is an important component that added to them confidence, a feeling of mutual responsibility, and partnership on the way.* For the physics teachers, an answer to their needs and challenges is important and especially meaningful, since they encounter many difficulties because of the special nature of the teaching of physics as a scientific and difficult subject (Etkina et al., 2017). Another perception that arose in the findings is that the learning community does not have anything to teach an experienced

teacher. Teachers maintain that the twenty years of experience they have behind them are proof that they do not need to learn more. In response to the question of what is her attitude towards the PLC, an experienced teacher said that she came with the clear knowledge that she does not have anything new to learn and she did not understand what she could obtain from the meetings. This finding is commensurate with the professional literature. Research studies that address professional development describe teachers who are not aware of their desire to change their way of teaching. The intention is experienced teachers who have already created for themselves effective teaching methods that prove successful in the classes. They maintain that there is no need to change their approach into teaching with innovative strategies and contemporary contents (Yerushalmi & Eylon, 2013). Therefore, it is possible to conclude that for teachers to examine with their colleagues' everyday problems in teaching, in a critical and advancing way, they are required to acknowledge that they have something to learn from their colleagues' experience and interpretation of their colleagues of these problems. Hence, professional improvement requires the teachers to acknowledge both the boundaries of their efficacy and the fact that there is no boundary to learning and professional growth.

The fundamental assumption of the researchers is that the teachers' professional development occurs throughout their entire career, as they acquire experience in teaching. Alongside this fundamental assumption, empowerment and support of the teachers' development of knowledge and skills and change in the teaching ways are required. Change of the teacher's way of teaching is a complex process, continuous and gradual (Eylon & Bagno, 2006). In the chapter of the findings, it is possible to sense the structuring of the new knowledge through the adoption of the teaching methods learning in the community. The teachers carry out evidence-based learning focused on the student and advance not only the ways of teaching but also the learning of physics itself. In other words, the interpretation of the students' responses empowers both the teachers' knowledge in physics and the knowledge in the teaching of physics. All this is done in a lengthy process of the change of the teaching approach and the structuring of new knowledge that is accompanied by community support.

There is broad agreement in the research literature on the teachers' need to continue and develop professionally in order to improve their quality of teaching and consequently the students' learning (Timperley et al., 2008). The findings confirm that the learning community is an excellent place for the physics teachers to acquire knowledge, to implement it, to form their professional identity, and to undergo a process of personal and professional empowerment that leads to expertise in teaching. The data of this research study indicate that in the Paris Community the teachers learn methodically and over time in order to improve the teaching and so that the learning in the schools will be of quality and meaningful.

The teachers' perception of the community goals is commensurate with the literature. The teachers examine with their peers their teaching and the students' learning in order to promote innovative ways of teaching suited to the students' difficulties (Levy et al., 2021). The findings indicate that all the teachers find their participation in the community to be an experience that advances them professionally. There are mutual relationships and connections between the teachers' educational perceptions and their personal beliefs on the topics of teaching and the ways of action in the classroom (Kim et al., 2012). Therefore, to establish a change in the classroom, it is necessary to focus on the teachers' approach to the implementation of innovations, diverse teaching methods, and learner-focused learning environments. The data indicate that the contents to which they were exposed in the community influenced their pedagogical perception. The professional change created a feeling of progress, renewal, and growth. The restructuring of the professional knowledge is created, through the diversification of the ways of teaching and acquisition of new skills. The reflective observation on their work was also found to be a powerful tool for the improvement of the teaching and the students' learning (Eylon et al., 2008). In-depth thinking, rich discussions, and reflection can lead to change of the teachers' outlook and shaping of their professional identity. Consequently, the physics teachers' change of the perception will effectively penetrate into the class and the students (Bryk et al., 1999; Sassi & Michelini, 2014).

Another interesting perception that arose in the findings is the feeling of pride that the teachers felt at the very fact of their belonging to a unique group that creates knowledge.

It becomes clear that the participation in the community creates pride in the group. The feeling is that this group can contribute, help, develop, and advance every teacher in the community. In addition to the solid support provided by the meeting with valued colleagues, teachers feel that they have power as a group and are not alone in the battle. Research studies confirm that the community atmosphere creates a feeling of partnership towards the colleagues, the profession, the community, and the shared goals. *This is an internal sense of identity and belonging since the teacher is a part of a large whole and the whole is greater than the sum of its parts (Marzel & Arica, 2021).*

The prominent finding indicated by the research is the perception of the community culture that influences in different circles the experience of learning and motivation to learn. The first circle is created from the social motive. The teachers come with enjoyment to the meeting and are happy to learn from one another. In accordance with the research literature, according to which the relationships between the community members are supportive, there is trust and confidence between them, and thus it is possible to leave the zone of comfort and attempt new things (Waldman & Blonder, 2020). In the second learning circle, the experience of the meeting creates the motivation for higher learning. The teachers become meaningful because they create knowledge and build new and more precise teaching processes for the student and the teacher. Providing validity is given in the research study of Harrison et al., (2008), which asserts that effective change in teaching is caused as a result of the teachers' active learning. In the third circle, a learning experience is created as a result of the cohesion among the community teachers. The collaboration creates commitment to learn and advance. Intimacy and responsibility to create knowledge appropriate for a burning topic that arises from the needs of the Paris Community teachers are created. This circle too is commensurate with the description of Marzel and Arica (2021) on the sense of a shared fate that creates mutual commitment and shared responsibility for the community's actions and products as well as "shared bearing of the burden".

In the findings it was possible to also hear the voice of the new teachers, who expressed the desire to learn in a supportive professional environment. Their perception of the community is for the providing answers and accompanying the teachers who have

completed their training. They hold onto the community as a safety net and attempt to find support from their experienced fellows. A teacher who has finished the studies for a teaching certificate must continue to develop and be accompanied in a professional learning community, for the purpose of support, growth, and progress (Borko, 2004; Geijsel et al., 2009; Kim et al., 2012).

Research studies confirm that the communities of physics teachers are a framework suitable for long-term professional development of both experienced and new teachers (Levy et al., 2020). The social interactions help the young teacher in the development of his professional identity and in the bridging of the gap in the professional knowledge. The data indicates that the shared learning of a new teacher and an old teacher enables the growth of both sides. The experienced teacher regains enthusiasm with the teaching and a spark in the eyes. A new teacher feels that he is obtaining a safety net and he is being supported, and in this way a smooth entry into teaching is made possible. The dynamics between beginning teachers and experienced teachers enables mutual cross-fertilization and together they create knowledge through collaborative planning that can serve as a learning arena for experienced teachers and new teachers (Eschar-Netz & Vedder-Weiss, 2021).

The research participants' perception indicates that the first teaching instrument in importance is professionalism and mastery of the learning material, and thus every teacher needs to continue to work continuously and in-depth. A learning community is the most suitable place for passing the first years of teaching since it is possible to be helped by a diverse, and professional group of people (Avdor et al., 2010; Vurgan, 2008).

Research studies show that teachers at the start of their path in teaching build their concepts and teaching strategies in their new job. Hence, the community is a place that shapes their professionalism. The findings confirm that the contents of the Paris Community emphasize the building of a protected environment, in which the teachers can share difficulties and dilemmas – a critical aspect for the building of the professional resilience of new teachers (Putnam & Borko, 2000).

It is possible to see in the feedback that the new teachers who join find in the community a home, a greenhouse, a listening ear, advice that somebody more experienced can give them. The dynamics between the experienced teachers and the new teachers can stop burnout and create a feeling of renewal and freshness among the experienced teachers and learning among the new teachers. In this way, the two sides benefit and develop professionally. The human richness creates diversity and a productive conversation in every meeting, provides answers, and strengthens the new teachers' self-confidence. This is commensurate with the research literature, in which the PLC develops among the new teachers their professional identity, sense of self-efficacy, and belief in their capacity (Levy et al., 2020). On the basis of Gilad (2001), it appears that there is need for the communities to tailor their aims and contents to the stage in which the teacher is found on the developmental axis.

To conclude, the examination of the research participants' perceptions, primarily on the integration of the new teachers in the community, indicates that when experienced teachers and new teachers work together they share ideas, motivate one another, and cross-fertilize one another. They share materials, contribute from their experience, and benefit from one another's pedagogical knowledge. The contents in the community build the professional backbone of their learning process as new teachers – teachers who are more attentive to their students and aware of the difficulties in the teaching of physics. Not only young teachers need the re-examination of their ways of teaching. Experienced teachers also noted that the meeting with other teachers empowers their professional confidence and causes them to undergo self-discovery.

5.2 What Is the Contribution of the Professional Community to Changes in the Contents and Ways of Teaching Occurring in the Physics Teachers?

Insights on the Teachers' Perceptions of the Changes in the Practice in the Classroom following the Learning in the Community

The physics teachers' attitudes regarding the practical implications in the practicum in the classroom as a result of the interaction in the community reflect the conceptual change they experienced. Their feelings represent their teaching approaches in actuality after the assimilation of innovative processes with a "learner-focused" emphasis. Their perceptions primarily address the increase of the depth of the disciplinary and pedagogical content knowledge and the implementation and restructuring of their professional knowledge (Dogan et al., 2016).

The research question: What is the contribution of the professional community to the changes in the contents and teaching ways that occur among the physics teachers?

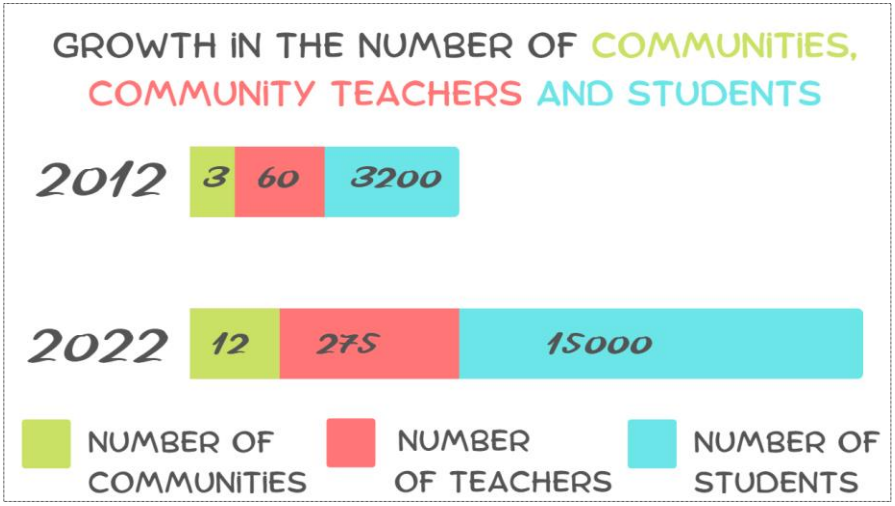
One of the objectives of the research study was to examine the contribution of the PLC to the professional changes that occurred among the physics teachers in the researched community. The research study attempted to bring up the participants' feelings and insights and to analyze the implications they have on the nature of the learning created in the community and instruction of the topics in the class. The research findings show the factors that contributed to the professional growth, as well as the changes in the teachers' knowledge, attitudes, and practice. The insights on the contribution of the community to the change in the ways of teaching and learning contents of the physics teachers from different aspects are presented as follows:

The teachers' perception of the contribution of the community to the changes that occurred in them in the ways of teaching and contents is apparent from the research findings. It is possible to understand that they see the community to be an environment that provides an answer to their changing needs and even changes according to their personal needs. They note that the activities they experience contribute to the change in their traditional teaching practices, the diversification of the teaching methods, and a sense of

growth and renewal. It is known from the literature on the PLC that the teachers receive in the community all the support they need in order to advance their practice, outlook, and knowledge (Vescio et al., 2008). It is apparent from the reports that the biweekly meetings, month after month, year after year, caused the innovation of the teachers' teaching ways following the intensive exposure to diverse teaching methods. The teachers in the PLC are active learners who shape their professional growth through reflective participation in the program for professional development. Every teacher is an independent learner who comes with professional experience to the collaborative community that serves as a nurturing learning community (Levy et al., 2021).

The feedback indicates that the teachers weigh the legitimate difficulty in coming to the community versus the benefit obtained in the collaborative meeting, and the balance tilts in the direction of the advancement of the teaching and personal growth. The research findings confirm that the professional development is perceived by the teachers as a means for the improvement of the students' learning experience and achievements and outweighs the technical difficulties. As proof, the number of teachers in the communities has increased every year, and the number of students exposed to experiential teaching has increased accordingly, and within a decade the number of teachers in the community has multiplied by a factor of nearly five (Levy et al., 2021).

Figure Number 22: Growth in the Number of Communities, Community Teachers, and Their Students



Source: Based on Levy et al. (2021)

The research respondents noted activities and contents to which they were exposed in the community that caused them the self-discovery of their abilities as teachers. They admitted that they chose to give up the traditional lesson plan and invested in an attractive and relevant lesson that would stimulate their students' curiosity. The knowledge they acquired in learner-focused teaching enabled them to customize the proper teaching method for each one of the students. Furthermore, the teachers acquired new skills for the creation of conceptual understanding for their students and defined them as another stage in their professional development. According to Timperley et al. (2008), the information on what the students are required to know characterizes also what the teachers are required to know. The prevalent assumption in the research study is that the process of the change in the teacher's perception of the teaching requires them to monitor their professional development. It is necessary for the teachers to carry out reflection on the effectiveness of the changes they performed in their practice and to ascertain that these changes indeed advance their students' learning. It appears that in an unconscious manner the teachers examine the changes in the practice again and again, with daily experience in the classes in order to recognize the correctness of the change. It becomes clear that the change indeed is happening, and the research of Levy et al. (2020) indicates that the communities have succeeded in promoting the teachers' professional development. The change is expressed in the promotion of the students' learning and the assimilation of the new ideas in the teaching of physics in the classes of the teachers of the regional communities.

The most prominent aspect in the findings is the exposure to different teaching possibilities in a wide range of study topics in physics. Teachers noted that the instructors and community members present and share experiments, competitions, teaching strategies, and explanations. They confirm that an experienced teacher also needs a learning experience in order to refresh his way of teaching and exposure to another world of contents enriches and diversifies his practice. The resources that the teachers bring from themselves, in combination with the resources that come from the Weizmann Institute, create a pedagogical advantage. The research of Vossen et al. (2020) confirms the data and maintains that the community teachers who come from a different professional background build together the teachers' knowledge and teaching strategies and that this is an excellent

platform for the improvement of each teacher's personal pedagogical knowledge and the group's collective knowledge.

Another finding indicated that every teacher engages actively in the personal learning of the creation of his knowledge, while he is accompanying the learning with a conceptual and critical discussion of the existing knowledge he attempts to improve. In accordance with the research literature that asserts that in the PLC there are discussions in which the teachers associate between scientific content and innovative learner-focused teaching approaches, in this learning space the teachers share ideas and hold discourse relevant to the areas of their academic interest (Eylon et al., 2020). In the meetings, emphasis is placed on the sharing of knowledge among the teachers, the building of knowledge, and cooperative work based on the considerable experience accumulated among the teachers of the community. The uniqueness in the community is that the teachers share with one another the variety of activities that they already carried out in their classes and they come with insights and a practical perspective. Hence, in the retrospective analysis, every teacher brings his personal perspective and everyone learns from everyone. The considerable influence of the collaborative knowledge anchored in the data is reinforced in the professional literature in the fact that the teachers in the community who share with their colleagues about their teaching experiences develop different approaches to the teaching of the sciences and as they deepened their knowledge they improved their practice (Dogan et al., 2016).

The discussions and conversations are meaningful and powerful instruments for the purpose of the construction of the knowledge in physics and in the teaching. In the reflective discourse, the teachers respond, give interpretation, and learn to know challenges in the professional work of their colleagues out of mutual respect and appreciation. The discussion creates reflective learning of physics and the teaching of physics. The conversations enable a collective re-examination of the students' learning, effective teaching methods, and learning from the successes. These data are commensurate with the research studies of Berger et al. (2008) and Borko (2004) about a reflective dialogue that enables active collaborative learning, through effective professional development.

The chapter of the findings noted that the teachers appreciate the resources they receive from their colleagues and primarily the fact that the proposed activity is already prepared for deployment in the classroom and there is no need to carry out tailoring for the lesson. In this way, a teacher experiences in the community an activity that can already the next day be implemented in the classroom. This is a specific activity adapted to the specific chapter in the curriculum that is required to be taught at that time in the schools. In this way, the teacher acquires the skill and in parallel broadens his knowledge on the topic. According to Dogan et al. (2016), teachers redefined their perception regarding the teaching strategies and the effective way of realizing them in the classroom through the assistance from their community colleagues and thus broadened their disciplinary knowledge. The findings indicate that in every meeting there is the exposure to a variety of instruments intended for the improvement of the teaching, as well as strategies for the organization of the knowledge and the creation of interest for the students. Bagno et al. (2021) advocate that physics teachers long for tools and methods that will upgrade their teaching, not only at the level of the diversification of the teaching but also especially at the level of increasing the depth of understanding of their students' learning and increasing their repertoire to provides answers for their students' difficulties. Buabeng et al. (2018) maintain that physics is a scientific subject in which the students are required to master complex knowledge and higher order skills and thinking, for the purpose of literature and scientific investigation. Hence, to create a learning environment that advances learning, the teaching of physics must undergo a change of paradigm. It is necessary to shift the focus from practice, memorization, laws, and formulas to pedagogical development that supports inquiry learning, the creation of conceptual understanding, and analytical skills among the students (Timperley et al., 2007).

The findings of the present research study indicate that the perception behind the idea of the PLC breaks the learning paradigms and requires the teachers to be active in the process. Effectiveness is created in this type of learning following the commitment, intimacy, and desire to create precise knowledge for the teachers' needs and arises from the field. The continuous and consistent process of the learning in the meeting creates change in the ways of teaching in the professional aspect, and the teachers change from passive participants to members of the community involved in contents, knowledge, and

social interactions. It appears that Dogan et al. (2016) maintain that the presence of many teachers in every meeting who think together about a problem out of active experience in inquiry-based learning creates a new perspective on the teaching, though collaborative community learning. The findings confirm that the teachers' active learning brings with it the experience, expertise, and professionalism of the peers. The teachers' contribution, each teacher in their own way, enables the investigation of the teaching and the focus on the students' learning.

The literature presented in the review earlier in this work described a model in which leading teachers receive training in the Department for the Teaching of the Sciences at the Weizmann Institute (Hans et al., 2013; Eylon & Bagno, 1997). The leading teachers make the contents they acquired accessible to the teachers of the regional communities. The teachers of the regional communities' experience and discuss activities and take them to their classrooms. In this way, the knowledge permeates and spreads to thousands of students (Gilad, 2001; Michaeli & Sommer, 2014).

A surprising and intriguing finding arising in the research is the *bi-directionality of the fan model*. If we were to expect that the knowledge would permeate from the head of the fan, the scientists of the Weizmann Institute, through the leading teachers, to the teachers in the community and then to the classrooms, the findings of the present research study indicate that *there are three directions of the flow of knowledge*. This surprising fact can be explained by the nature of the special learning occurring in the communities. The findings make it clear that in every meeting the teachers of the Paris Community are exposed to and practice innovative teaching strategies.

At first, they experience the contents as learners; in other words, they answer the activity as they believe the students would answer. After a plenary discussion and the drawing of conclusions, the teachers transfer the activities to their classrooms. The assertions of Berger et al. (2008) and Borko (2004) confirm that active and collaborative learning of teachers enables effective professional development since it is carried out through reflective dialogue. In the second stage of the learning, the teachers return to the community with insights, criticism, and changes they believe are necessary. In the

discussion they present the students' products and share experiences, difficulties, and successes in their class. This part too contributes to the professional growth, as indicated in the research study of Clarke and Hollingsworth (2002), who believe that active learners in the community of teachers who carry out collaborative reflection during their practice advance their professional development.

The interesting innovation that arises from the findings is that *now the direction of the flow of knowledge is reversed* and the leading teachers convey the insights back to the researchers of the Weizmann Institute and make changes in the activity. Another important fact that arises in the findings is that *there is another, a third, reversal.* The academic backing of the Weizmann Institute returns the activity for critical review in the community and the activity is once again passed on to the students. *In this way, the contents go up and down the fan.*

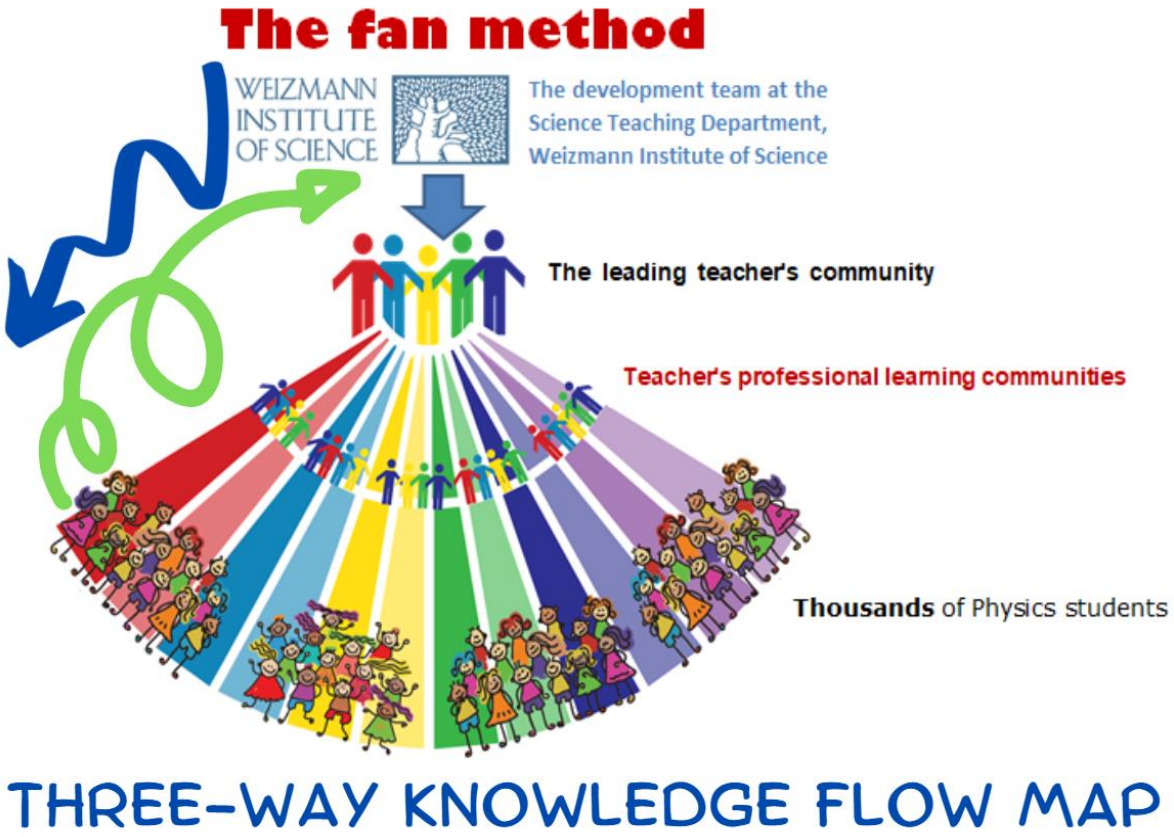
The professional literature confirms that when a teacher is required to analyze the activity he held in the class and to make the adjustments required for his students, the repeated experience after the change and adjustment is more effective and will advance the assimilation of the innovations in the teacher's practice over time (Levy et al., 2020). Accordingly, in the last stage, after the final approval of the community teachers, the corrected materials are brought to all the teachers in the country. These facts confirm the importance of the community teachers' insights regarding innovative teaching strategies. They also are commensurate with research studies on the development of knowledge that rises from the bottom of the fan to its head, in that the responsibility for the knowledge becomes active and shared and not passive (Eylon et al., 2020) and thus the internalization and assimilation will be effective and retained over time.

The findings reinforce what is known from the literature, and it appears that teachers who conveyed any process after which they carried out reflective investigation of their students' findings indeed assimilated the innovative strategy they learned in their teaching practices in the classroom. In addition, all the time there is diffusion of the transfer of knowledge and development of activities among the community teachers, the leading teachers, and the academic support of the Weizmann Institute. In this way, the scientists at

the top of the fan are enriched in the up-to-date, creative materials that suit the needs arising from the field. This dynamic model enables advancement, growth, and development of the teaching of physics in Israel, in that the material flows both from the top and from the bottom of the fan.

To summarize, the professional contents in the PLCs were developed in cooperation between the academic staffs in the Weizmann Institute and the leading teachers who bring up the teachers' needs in the field. The fan approach, in which the knowledge comes from above and permeates downwards, has gradually become interactions and collaborative learning and led to a "change in roles", which included the more symmetric division of responsibility among the participants in the communities. These interactions in the PLCs created a developing "network model" of the transmission of knowledge (Eylon et al., 2020).

Figure Number 23: The Fan Method of Knowledge Transmission/Transfer Paths



Source: Own Work, Based on the Program from the Weizmann Institute of Science

The findings of the research study indicate another fact that is associated with reflection and collectivity. When teachers research together their teaching, they clarify their aims and their beliefs, develop new knowledge, and learn from the others' ideas and experience. Thus they broaden their knowledge on their students' learning and enrich their toolkit. It is possible to understand from Clarke and Hollingsworth (2002) that the very fact of the reflective conversation about the teaching already creates an improvement in the teaching. The analysis of the research findings shows that the teachers develop professional conversations and bring up difficulties both in the teaching of physics and in the students' learning. The reflective investigation reveals different perspectives and creates mutual cross-fertilization and cooperation through learning based on the authentic testimonies that the teachers bring from their classrooms. In this process, as aforementioned, a teacher brings findings from his classroom and all the teachers of the communities re-examine the students' works and draw conclusions. The teachers noted that in the community space they feel confident to share the teaching practices and professional dilemmas. This is commensurate with the assertion Etkina et al. (2017) in which the community is presented as an environment that enables reflective investigation of the teaching for the purpose of the advancement of shared values, the change of practices, and the creation of enthusiasm, desire, and a feeling of identity from the teaching of physics.

In the present research study, it appears that the teachers' feeling that their teaching benefits and improves following the use they make of innovative strategies is at the basis of the shared desire to continue to come to the community and to dedicate time in the meetings to activities of this type that enable the promotion of the learning. The analysis of the feedback indicates that the circles of assimilation of the teaching processes for the advancement of the knowledge ensure exposure and then learning and internalization.

Thus, the familiarity with the processes deepens and the awareness of their immense importance in improving classroom instruction increases. This finding is anchored in the assertion of Bagno et al. (2021) that the repeat engagement in familiar activities, different opportunities, and different contents instills these learning processes in the learning and teaching. The very repetition of the contents from different angles creates at first confidence in the understanding and in the end the internalization and assimilation

of them. The prevailing assumption in the research study is that as the exposure and use of teaching processes and the specific activities that they invite will increase, the teacher who has been exposed to them and learned them will continue to implement them in his classroom over time. The community enables this in that the teachers together attempt the activity, research their teaching actively, learn from one another, and in the end the influence is created on the practice (Grossman et al., 2001). In this way, the community instills in its teachers a strong professional backbone that will remain over time and create in the class experiential teaching.

The findings of the present research study indicate that the teachers indeed regularly incorporate in their physics classes the ideas and activities they have acquired in the community. Some of them change and adapt them to their needs in the different age groups, in the different issues, and in the diverse contexts. Many noted that they realized how much the innovative teaching processes had improved the teaching and thus contributed to their students' learning. In line with the research literature confirming that the learning in the proffeshional community of physics teachers promotes the implementation of learner-focused teaching strategies (Levy et al., 2020), an interesting finding brought to the awareness the fact that the teachers use the processes *only after they attempted them in the community a number of times and acquired full confidence in their ability* to integrate them into their teaching routine. Teachers reported that generally they change and adjust the strategy to their needs and preferences and those of their class. Bagno et al. (2021) also confirm this intriguing fact.

A surprising finding arose from the reports on that the teachers sometimes are skeptical about a certain implementation learned in the community. Some of them decide *to use it and attempt it only after they heard from their colleagues in the community* about how successful their deployment in their class was. This fact strengthens knowledge from the literature about the pedagogical idea behind the pattern of action of the internalization of processes. The community teachers share with their peers the implications and experiences in the implementation of the new contents. The new teachers share their fears, the experienced teachers contribute from their experience, the instructors bring the voices of experts from the fields of education, and together an atmosphere of change is created

that facilitates the teachers' practice in the introduction of changes into the classroom (Clarke & Hollingsworth, 2002).

As aforementioned, in the present research study, the physics teachers of the Paris Community believe in their colleagues' success and in cooperation between all the community teachers. The professional discourse and the shared work encourage them to attempt to make changes in their way of teaching in order to teach experientially and create better understanding in the student. It appears that Eylon et al. (2020) confirm that the academic and pedagogical knowledge built contributes to the in-depth learning as well as to the internalization of the new processes. Consequently, the community teachers' reflective attitudes towards their practice are built anew. The findings about the activities in which the teachers sit together and build knowledge indicate that the assimilation of the new contents is better and continues over time when there is collaborative learning. This is commensurate with the research studies that address teachers who learn with their peers and grow from a place of a partial and passive participant to a place of a full and active participant (Eschar-Netz & Vedder-Weiss, 2021).

Another interesting datum arises from the teacher's sharing of his activity in the class in the framework of the regular time slots in the first part of every community meeting. The teachers or instructors methodically share ideas for an enthusing film, toy, or use of a successful strategy in their class. They share their experiences, difficulties, and successes of the activity and thus learn physics from one another (Darling-Hammond et al., 2017). The methodical repetition of the practice provides the teacher with a clear vision on what recommended work methods look like and enable the teacher to implement desired teaching strategies accurately.

It is clear from the reports that the exposure meeting after meeting to a new toy that illustrates a topic in the curriculum or illustrates a relevant experiment "for tomorrow morning" indeed influences and the teachers adopt the method and change if only a bit the traditional approach to the lesson. *These innovations are reinforced and become routine.* Darling-Hammond et al. (2017) added that meaningful learning translated to change of practice cannot be carried out in a one-time activity. It is necessary to engage continuously

over time in the professional development and thus there is a greater chance to change the teaching methods and the students' learning.

The findings even confirm the theory. Many teachers reported that the regular ritual in which in every community meeting a film, a picture or a toy is presented that is used to illustrate a physics law or exercise caused them to introduce it into their class already the day after the meeting. The literature also presents the regular time slots in which the teachers share interesting ideas, thought-provoking experiments, use of toys and surprising simulations as an important, systematic, and constant time that the community devotes to the teachers' everyday needs (Eylon et al., 2020), with the goal of making the physics lessons fascinating and diverse. It appears that the constant and continuous exposure to innovative teaching methods indeed succeeds in awakening teachers from settling into old and familiar habits and they bring a new and fresh spirit into the classroom. The regular ritual erodes the old work practices and enables the teachers to be accustomed, meeting after meeting, to the new skills.

To summarize this research study, in accordance with the research literature, Levy et al. (2020) indicate that most of the community teachers succeeded in carrying out changes in their way of teaching, and these changes even persist over time. The findings of the research show that the changes that occurred in the community teachers are long-term changes in the knowledge, in the perceptions, and in the practice. Hence, there exist in the regional communities' conditions for the teachers' continuous learning that will enable the assimilation of innovative and learner-focused teaching approaches and long-term changes in teaching

5.3 In the Teacher's Opinion, What Are the Causes of the Effectiveness of the Physics Professional Community?

Insights on the Teachers' Attitudes and Perceptions of the Causes of Effectiveness in the Coming to the Community צריך לסדר מספור

The answer to the third research question is implied from the two answers to the previous research questions. However, to answer the research question and identify the characteristics that create the effectiveness in the community meetings, we analyzed the teachers' answers in the interviews and feedback and their expressions during the meetings, while cross-referencing with the research literature. Insights arose about the teachers' attitudes regarding the effectiveness of the participation in the professional learning physics community in terms of peer learning, collaboration, mutual cross-fertilization, joint leadership, and consistent assimilation of the innovative ways of teaching and contents.

The research question: what in the teacher's opinion are the factors of the effectiveness of the professional physics community?

The teachers' perceptions, as they arise from the findings about the factors of the effectiveness of PLCS, are commensurate with the knowledge from the professional literature, in which it was found that the processes of effective professional development are characterized by (1) the teachers are involved in the learning process, (2) there is collaboration in the learning process, and (3) the learning process provides feedback and reflective actions exist in it (Darling-Hammond et al., 2017; Eylon & Bagno, 1997; Harrison et al., 2008). Moreover, it was found that the vitality of the learning community increases as the learning is challenging and as there is activity by the participants, which influences in the end the teachers' work in the classroom (Little, 2002; Michaeli & Sommer, 2014). Research studies that focus on the model of the PLCs addressed the effectiveness primarily in the collaboration of the teachers' learning, in the striving for the same goal, and in the sense of belonging (Bryk et al., 1999; Kim et al., 1999). The teachers noted that they see an advantage in the participation in the community since this causes them to examine in every meeting, methodically, along with their peers, their teaching and their students' learning. The findings indicate that the community contributes to a regular

and continuous framework for relationships between the teachers. The meeting enables seeking advice, mutual cross-fertilization, and receiving help from the peers. The collaboration becomes over the years more and more meaningful, until the community becomes part of the teaching of a teacher who develops and re-examines his teaching (Bryk et al., 1999; Lieberman & Pointer, 2009; Waldman & Blonder, 2020).

The prominent finding, impressive in the importance of the PLCs for the physics teachers, noted by the research study is the interaction with other teachers. All thephysics teachers, without exception, noted that the effectiveness of the professhional community is motivated by the social aspect far more than by the academic aspect. The learning grows from the mutual relationships and nature of the relationships forged among the community members. Every meeting in the Paris Community creates an empowering social-community experience because of the special atmosphere that reigns among the teachers. The respectful conversation creates a feeling of a fine social encounter, in which the professional parties are partners, speaking with the same professional language (McLaughlin & Talbert, 2001). The work with other teachers constitutes a means for the learning of new ideas, receiving feedback and support, and this is the most meaningful parameter for them (Anderson et al., 2000).

The social-emotional dimension describes the feeling of partnership among the community members, their being a part of something larger than the single individual. This dimension is particularly important for the physics teachers, who frequently are the only one of their kind in the school where they teach (Marzel & Arica, 2021). The findings of this research study provided further confirmation of the fact that in the schools there is a low number of physics teachers and in most cases only one teacher (Cohen-Brenner, 2017). Hence, the interaction with colleagues whose professional experience is esteemed enriches the teachers and adds to the self-confidence and to the feeling of partnership along the way and thus creates a learning community (Eylon et al., 2020; Wilson, 2013).

The analysis of the discourse indicates that the teachers believe that the meetings of the Paris Community constitute a support group in which it is possible to draw strength, unload difficulties, and consult on professional content without fear of criticism. This

finding is commensurate with the research literature in which the PLCs bring closer teachers who share the same feelings, problems, and professional difficulties and the support allows them to continue to improve and advance professionally (Anderson et al., 2000; Kozminsky et al., 2004). The findings of this research study confirm that the Paris Community meetings create renewed enthusiasm from the teaching and give a sense of belonging to the place in which knowledge, partnerships and professional development are created. Similarly, it is possible to rely on Grossman et al. (2001) and Waldman and Blonder (2020), who describe PLCs as an environment in which the teachers create community relationships, search for a shared language, and develop the social relations.

The review of the literature presented the effectiveness of the PLCs. The physics teachers meet with a large and diverse group of people, they learn together in a professional "home", and in essence they can find an answer to every problem that arises in them since there is always somebody to turn to and somebody to ask advice from (Gilad, 2001). The power that the learning community has is far stronger than the power of the single teacher and a "teachers' room for physics" is created that enables the professional and pedagogical sharing of ideas. Hence the combination of the social aspect and the professional aspect gives the teachers the motivation to continue and come to the community meetings (Eylon et al., 2020; Waldman & Blonder, 2020).

The analysis of the feedback indicates that the physics teachers feel they have benefited even from the side conversations between one activity and the next, in which they receive an indication about their pace of teaching and the direction of attention to topics that require different thinking. The conversation with other physics teachers synchronizes and enables the exchange of experiences and the development of knowledge. This is a "power multiplier" that strengthens the feeling of professional satisfaction (Anderson et al., 2000). In conversations held in the coffee time slot and in the breaks, the social relationships are created. A professional social fabric is created through discussion and exchange of tips about the little problems that the teacher experiences in his class (Eylon et al., 2020; Waldman & Blonder, 2020).

The teachers of the professional physics learning community have an identity defined by a common knowledge field, teaching skills shared for the field of knowledge, and commitment towards the field of knowledge (Etkina et al., 2017; Eylon & Bagno, 1997; Eylon et al., 2020).

The analysis of the discourse also indicates that the teachers feel they are a part of a community with a shared goal and created a system of relationships that enables them to learn from one another and to create shared tools of norms and skills that support the level of knowledge and expertise of the teachers and others in the community. They are proud to learn from one another, esteem their colleagues, the community members, as creators of knowledge, and thus build a respectful, appreciative, and empowering system of relationships. The findings indicate that the PLC members feel that they belong to a group that creates knowledge and engages in shared activities, mutual assistance, discussions, and knowledge sharing (Harrison et al., 2008). There is the simultaneous development of the content world and the community culture. The teachers improve the knowledge in physics and the knowledge in teaching physics through the creation of a culture of learning and shared deliberation (Little, 2002; Michaeli & Sommer, 2014).

The reading of the testimonies indicates that in the professional physics learning community the teachers trust and respect one another and thus a powerful social resource for cooperation, support, and reflective dialogue is created. This fact strengthens what is known from the research literature about professional development. As the system of relationships between the community members becomes dynamic, the trust, respect, and mutual appreciation are strengthened, and the social resources that the community members share develop and broaden (Bryk et al., 1999).

The prevalent assumption in this research question regarding the effectiveness of the PLC is that, to create a professional social atmosphere that advances learning, a strong sense of belonging to the group is needed. The findings confirm that the teachers are found in a personal relationship with one another and contribute to the group but also the community contributes to all of its members. The mutual influence and the ability of people

to meet the needs of one another reinforces the shared relationships and makes the community important and meaningful (Scherz, 2018; Waldman & Blonder, 2020).

If we were to expect that the effectiveness of the PLCs would be expressed in the receiving of learning materials, the findings of this research study indicate that the teachers in joint leadership create new knowledge in the community. There is not only the receiving of teaching aids but also the creation of contents that are specifically tailored for the teachers' needs. The collective power created enables improved teaching and serves as a support group and basis for the investigation of the teaching practices (Darling-Hammond et al., 2017). The source of knowledge and the source of power are the teachers themselves who in shared leadership succeed in creating precise and well directed materials for their students. Thus the teachers create energy and multiply their power for all activity of each and every teacher individually.

The learning activity advances the teachers' knowledge and mainly the skill of cooperation and reflection on the knowledge in physics and pedagogy (Eylon & Bagno, 2006). This fact constitutes an explanation of the prominent satisfaction of the teachers with the community as arising from the findings. The Paris Community teachers influence one another in a continuous and mutual process that increases the social interactions between them. There is a positive correlation between shared leadership and feeling of growth and change under the influence of the partners in effective learning (Berger et al., 2008; Eylon & Bagno, 2006; Eylon et al., 2020).

On the basis of research studies about PLCs and according to the findings, it is possible to determine that the collaborative culture appreciates and esteems every teacher, both as an individual and as a member who contributes to the group. The effectiveness of the professional physics learning community is because it is a body of knowledge and a support network with social and professional capital. The community increases the effectiveness and efficiency of the teachers' work, strengthens their confidence, and encourages them to be open and involved actively in the efforts to improve and change their ways of teaching (McLaughlin & Talbert, 2006). The analysis of the ideas and

feedback confirms that the sense of community and belonging is high and the teachers feel that they contribute and are contributed to simultaneously.

In the present research study, the findings show that despite the difficulties, the teachers continue to come to the community. They come twice a month, year after year. The spiral learning in which the activity is approached from another angle enables them to assimilate the contents gradually but consistently and the change in the teaching permeates slowly and constantly. Research studies on PLCs show that the learning community will be effective and efficient when the teachers come to the meetings that continue over time and in a gradual process assimilate the changes in their ways of teaching (Levy et al., 2020).

In this research study as well, the findings are commensurate with the fact that the teachers' participation in PLCs indicates the long-term professional growth they undergo. The examination of the findings of the research participants' professional development shows that the shared and continuous learning enables mutual cross-fertilization, as well as a feeling of belonging to the place where the knowledge, partnerships, friendships, and professional development are created. All this is commensurate with the literature, in which the main idea of the teachers' community is that they are a place for the improvement of the practice through continuous and collaborative learning (Grossman et al., 2001).

The effectiveness of the professional learning community is expressed in the refreshing and changing of the way of teaching of the physics teachers, who are required to be involved in the learning process in order to create change (Harrison et al., 2008). The findings show that the significant advantage is that every single teacher brings with him different knowledge and with shared strengths the collective knowledge of the professional learning community is shaped. The consistent experience and the colleague support create in the end the desired change in the ways of teaching that is the objective of the PLC. The ongoing experience in the context of the teaching in the class and the continuous support are vital components in the programs for professional development in order to allow the teachers to change their teaching practices (Eylon & Bagno, 1997).

Research studies on the communities indicate substantial changes in the teachers' knowledge, approach, and attitudes to the teaching process. The community provides the teachers with an opportunity to actively investigate their way of teaching, perform reflection on the practice, and analyze the outcomes while learning from the fellow teachers. The biweekly meetings enable the cultivation of the teachers' collaborative, active, and meaningful learning. They provide them with continuous support on the part of their peers who are undergoing similar experience in a respectful and nonjudgmental environment (Levy et al., 2020).

The findings indicate that in the PLC the teachers themselves are the learners, learning from one another and from the instructors. Thus for them an opportunity is created to strengthen their sense of self-efficacy and belief in their ability (Waldman & Blonder, 2020). The community environment enables the teachers to cooperate, reflect, and learn from peers in the topics that are important and relevant to them. The impressive finding indicated by the present research study on the matter of the shared learning is the fact that *in the community there is a process of the creation of knowledge and not only the receiving of knowledge*, and this is a meaningful innovation (Bryk et al., 1999).

The analysis of the findings also shows that the spiral learning is effective in the assimilation of the new contents in that the teachers must first of all be learners themselves (Martinovic & Horn-Olivito, 2020). After the experience as learners, they discuss and examine with their colleagues the feasibility of the strategy. The teachers implement in their classroom and return with insights and experiences. Again a discussion is held and collaborative learning occurs that enables the deliberation from other people's experience. The 'community' creates a support network, confidence in the group's ability, and the desire to learn from one another. The findings are commensurate with the description of the professional development in the communities presented at-length in the review of the literature earlier in this research (Grossman et al., 2001; Kim et al., 2012; Pointer, 2009).

To summarize, the answer to the third research question on the causes of the community effectiveness according to the teachers indicates three interesting phenomena. The first phenomenon is that it becomes clear that the absolute majority of the physics teachers come to the community out of a social need and less from a learning need. The experience of the learning, the longing for collaboration, for the creation of a "teachers' room", for mutual cross-fertilization and the combination of strengths empower the feeling that the teacher is a part of a community with a shared goal. The social learning is a "true power multiplier" that greatly reinforces the feeling of professional satisfaction. The respectful conversation among the Paris Community teachers creates a feeling of a fine social encounter, in which professional interested parties who speak the same professional language are partners.

A second phenomenon, which is impressive and surprising, is that in the community there is a process of the creation of knowledge and not only the receiving of knowledge. The collective strength enables the creation of precise and refined contents for the topics relevant to them. The teachers learn from one another, strengthen their sense of self-efficacy, and feel that they contribute and benefit simultaneously. The environment enables the improvement of the knowledge in physics and in the teaching of physics, through the creation of a culture of learning and shared deliberation when the teachers themselves are the source of the knowledge.

A third phenomenon is that there is the sweeping agreement that the continuous learning, shared, long-term, has created professional growth. The community creates belonging to the place where knowledge, partnerships, friendships, and improvement of practice are created through mutual cross-fertilization. The spiral learning enables the gradual but consistent assimilation of the contents, and the change in the teaching permeates slowly but persistently. The continuity and collaborative environment creates for the teachers a network of support, confidence in the group's strength, and desire to learn from the experience of one another.

5.4 Did the Change in the Teacher following the Participation in the Community Create a Change in the Students' Learning?

Insights on the Teachers' Attitudes and Perceptions of Changes in Their Students' Learning following Their Learning in the Community

Teachers perceive their teaching experience as influenced by their growth and professional development. They attribute their students' learning success to the conceptual change they experience as learners in the PLC. The Paris Community is a stable conceptual framework that supports change and assimilation of innovative practices that provide a solution to the students' difficulties and is focused on the improvement of their learning. The long-term engagement in physics and teaching physics makes the community teachers more professional in their field and the changes that they adapt for themselves permeate to the classes, create a deeper understanding and an increase in the number of students studying physics (Levy et al., 2018).

The research question: Did the change that occurred in the teacher following his participation in the community create a change in the students' learning?

There are synergetic relationships between the teacher's growth in the professional physics learning community and the teaching of the students in the class and the creation of an experiential climate that sparks learning. The promotion of the students' learning is both the ends and the means that serves the professional learning community. The community members act together to analyze different levels of students' learning, improve teaching practices and students' achievements, and develop strategies for the achievement of these aims (Dogan et al., 2016). Moreover, the community members cooperate in the analysis of the findings on the students' learning in order to discuss them and draw conclusions regarding the students' understanding of the learned material and regarding the influence of the changes in their teaching practices.

Research studies show that one of the goals of the physics teachers who come to the professional learning community is to learn strategies and new contents in order to advance their teaching and thus to improve the teaching of the students in the class (Bryk

et al., 1999; Caena, 2011; Kozminsky et al., 2004). Another main objective they strive for is the realization of their students' utmost scientific potential. This potential is composed primarily of the students' analytical ability but also is influenced by the feelings that they feel towards physics and the learning of physics. Hence, it is possible to assume that a teacher who will teach in the community and improve his teaching ways will succeed in increasing the interest in the studies of physics and indirectly will realize the scientific potential embodied in every student.

The findings indicate that in addition to the diversification of the teacher's ways of teaching and advancement of the processes of understanding, the increase of the motivation to learn will be created among the community teachers' physics students. The interest in physics is intensified, and improved interaction between the student and the teacher and the students themselves develops.

If we remember, in the review of the literature the students expressed difficulty in the physics studies, boredom, and need for investment of effort, then we can connect between the teacher's learning – and improvement in the teaching of the students in the class. Research studies showed that this sense of frustration is not exclusive to students and the physics teachers themselves maintain that the subject is challenging and intended only for the most talented students (Eylon et al., 2020). Hence, it is necessary to address this issue from the foundation and cultivate the concern of the teachers towards all the students in their class.

Regarding the findings, it is difficult to overstate the singular weight of the challenge that teachers feel due to the differences between the students in the class. The class is heterogeneous, the students differ from one another, they learn at a different pace and they have diverse needs. The physics teachers feel that they are required to learn, on a regular basis, how to customize the teaching to *everyone*. The community enables the learning of new instruments and innovative teaching strategies that help with this challenge (Berger et al., 2008; Eylon & Bagno, 2006). The findings are commensurate with many research studies on PLCs, in which the participants reported the importance of the project both to the physics teachers' teaching and to their students' learning. The learning in the

community gives the teacher innovative and research-based tools that have a great and sometimes even dramatic influence on the students' learning (Bagno et al., 2021). On the basis of the literature that is accompanying the work of the communities it is argued that the *teachers are the main factor in the students' learning* (Caena, 2011). These research studies examine the community's contribution to the professional development of the teachers who are participating in the process and the influence on their students in terms of achievements, attitudes, and motivation to learn physics (Eylon & Bagno, 2020). The findings of this research study confirm that the teachers must know how the students learn and in what way to provide an answer to their personal difficulties (Cohen-Brenner, 2017). In addition, they must know how to motivate the students to learn and to see to their diverse needs in terms of their learning styles and fields of interest. In other words, the teachers must direct their teaching in a 'learner-focused' approach (Eylon et al., 2020).

The chapter of the findings presented the responses of many teachers indicating that following the learning in the professional learning community of physics teachers they changed their ways of teaching and thus a change in the class climate was created. The teachers of the researched community teach nearly one thousand students, and the findings represent a not insignificant number of students whose teachers undergo a continuous process of change in the teaching methods.

In the review of the literature the two-way relationship is noticed: the change in the class depends on the change that the teacher feels, and the change in the teacher influences the change in the class (Eylon, 2013). It appears that the current learning environment obligates the increased depth of the teachers' disciplinary knowledge at the same time as the development of learner-focused teaching practices (Bagno et al., 2021; Darling-Hammond et al., 2017).

The present research findings indicate that one of the components of the improvement in the learner-focused ways of teaching is expressed in solving problems and difficulties that the teachers experience during the lesson. The sharing of the problem in the community enables it to be examined by all the teachers of the community, with feedback and discussion of a possible solution (Anderson et al., 2000; Bolam, et al., 2005).

The findings are commensurate with the research literature that recognized the considerable importance of the PLCs in the improvement of the learner-focused teaching skills. The professional physics learning community constitutes a means that supports knowledge, which empowers the teachers' sense of efficacy in providing a solution to their students' needs (Dogan et al., 2016). The review of the literature at the start of this work, which focused on students who choose to study advanced level high school physics, indicates that they feel that they are facing a high hurdle. This is a challenging subject in which the knowledge and skills are built together and hence the way of teaching has a special role (Cohen-Brenner, 2017). The analysis of the research findings indicated that the teachers report difficulty in the balance between high levels of depth and thinking and the need to provide a personal solution for every student, as aforementioned, learner-focused teaching. This is commensurate with the review of the literature in which the acquisition of teaching processes in the community gives the teachers practical instruments that support such clinical teaching (Berger et al., 2008; Eylon & Bagno, 2006).

In the professional literature it was argued that learner-focused teaching is what links between the teacher, the student, and the learning material, and its aim is to improve the learning. The professionalization on this topic in the community will cause changes in the teaching method, improve the teacher's ability to teach in the class, and lead to the improvement of his students' learning (Kozminsky et al., 2004).

The teachers revealed their desire to improve the students' learning in the class and noted that they acted to achieve it through their learning in the community. They come to deepen the knowledge in physics and make the teaching in the classroom more diverse and interesting. These data that arise from the findings strengthen what is known from the literature about the fact that the teachers in the communities undergo meaningful processes of knowledge towards the achievement of learner-focused approach (Eylon et al., 2020). The sum of the contribution from the community that the teachers feel is built through constant exposure to the current information and continuous learning process.

It was found in the literature that learning in the PLCs has influence on the teachers' practice and there is a positive impact on the students' achievements (Darling-Hammond

et al., 2017). Taking into account the fact that about one-quarter of the physics teachers in Israel participate in the project, the influence of the professional learning communities reaches thousands of students who learn physics at the level of five units of study in the high school (Marzel & Arica, 2021; Vescio et al., 2008).

In the chapter of the findings, the teachers reported a feeling of improvement in their students' learning experience as a result of the improvement in their teaching experience. This fact is commensurate with the literature, in which the students expect the community teachers to present the innovations they bring and appreciate the very fact that their teacher continues to learn and develop. This fact strengthens research studies on the PLC, in which the main idea is that all the teachers of the learning community are themselves learners (Darling-Hammond et al., 2017; Martinovic & Horn-Olivito, 2020).

The analysis of the research findings indicated a number of learner-focused teaching processes that became clear were powerful tools for the increase of the teachers' awareness of their students' learning and their awareness of their shortcomings in teaching. These processes learned in the community put at the teacher's disposal teaching strategies that can with relative ease be deployed in the classrooms and thus cause a meaningful change in the teaching of physics (Berger et al., 2008; Eylon & Bagno, 2006).

A correlation was found between the findings and the literature that describes the deployment of a process of teaching that allows the student to reveal the original knowledge he holds and the teacher to be aware of this knowledge. The student discusses the activity with his friends and with the teacher and asks to examine how his knowledge has changed during the learning. These reflective stages ensure the meaningful learning of new knowledge (Bagno et al., 2021).

The findings of this research study indicate that in addition to receiving teaching processes, different activities and skills acquired in the community were adopted by the teachers and conveyed to their students in the class. The teachers reported success in the classes and cooperation of the students who were happy with the change and the creative activity. Much feedback detailed the manner of integration and the great importance that the teachers attribute to the new strategies and instruments in the improvement and

upgrading of their teaching and primarily their students' sympathetic responses. This fact that arises from the findings reinforces the knowledge from the literature that the communities of teachers is a platform that enables the strategies learned and attempted in the meetings to enter into the classrooms (Gilad, 2001; Little, 2002).

The findings indicate that the meetings in the community with different teachers and teaching strategies focused on the different chapters of study helped the teachers diversify the teaching and created in the class innovation and interest. The message that the teacher also learns was not missed by the students, who were amazed to discover that the teacher does not know everything. The students were happy about every innovation that came from the community, especially the laboratories and the films, and noted that they also had an interest in their teacher continuing to develop in the community. This is commensurate with the research literature, in which teachers reported that the number of students in their class who chose to learn physics grew following the changes they carried out in their ways of teaching and attributed this to their participation in the professional learning community (Levy et al., 2020). It is apparent from the teachers' testimonies that there are indeed changes in the classes. In the research literature there is a reservation; it seems that the changes do not occur in all classrooms and not at the pace that the project thinkers expected, but much more slowly. It is clear that it is not easy for the teachers to adjust to the new teaching methods and accordingly it is not easy for the students, but the assimilation develops and extends to more and more students (Etkina et al., 2017).

In the chapter of the literature it appears that changes occur in the class not only through the introduction of processes for the integration of knowledge. The teachers draw ideas for a successful lesson also from the demonstrations performed in the community and even share insights from the experience (Marzel & Arica, 2021). They empower the basic activity to higher levels of inquiry, experimentation and additional aspects that enrich the learning and create higher order thinking. There is correspondence between the literature and the findings in which the teachers report that the perception in the classroom has changed, both following the inquiry activity and from the integration of multimedia means that engage in the physical issues relevant to the students' world.

A short activity such as a toy or demonstration that can be easily incorporated in the framework of a regular lesson, without the need for essential change, always excites the community teachers, and insights from the activity come up for discussion (Marzel & Arica, 2021). This is a way to diversify the lesson and make it more enjoyable and relevant. The creation of enthusiasm in the teacher will inspire enthusiasm in the students in the class and create change in the attitude towards the subject of physics.

Research studies indicate that the PLC is intended to accustom the teachers to use learner-focused teaching strategies and its aim is to develop and intensify the student's conceptual understanding (Levy et al., 2020). They are commensurate with the findings on the promotion of shared learning in the class that will in the end lead to the students' confidence in the understanding of physics. The change in the ways of teaching that the teachers adopts for themselves in a long-term in-service training course in the community will penetrate into the classroom and create a greater depth of understanding and increase in the number of students interested in learning physics (Levy et al., 2018).

As aforementioned, in the present research study the findings confirm that the professional physics learning community teachers open the door to their classroom and share with their colleagues the quality teaching materials and successful activities they developed. They hold a reflective discourse on the activity, their teaching, and their students' learning, in accordance with the research literature in which the teachers mediate for the students the learning materials they acquired and deploy in their classrooms the innovative teaching methods and thus seek to examine the influence of the innovations on the students' learning (Darling-Hammond et al., 2017).

On the basis of the literature, it was found that the study of physics is considered by the high school students to be the most difficult and complicated subject of all the areas of science they learn. However, when the students engage in tasks that motivate and challenge them, they discover that the studies of physics become enjoyable (Guido, 2018). The analysis of the findings indicates that the students of one of the teachers chose to call their WhatsApp group 'PhysiKef' (in Hebrew, a portmanteau of the word *physika* [physics] and the word *kef* [fun], or 'PhysiFun'), hence indicating without a doubt that they enjoy

learning this subject that is considered technical and complicated. This fact strengthens the models anchored in the literature that *when they themselves create knowledge through films and toys they make the lesson intriguing and enjoyable.*

An interesting finding showed a self-learning experience that one teacher created for his class, in which a student teaches his fellow classmates. He adopted this strategy after he was exposed to it by another teacher who presented in the community. In his opinion, this action leads the student who is teaching to have a greater depth of understanding in the material. The assimilation of the topic in the memory and the ability to make future use of the learned information are created in him. This model of peer teaching strengthens the knowledge from the literature that self-learning develops responsibility for learning with enjoyment (Buabeng et al., 2018).

The analysis of the findings indicates that the teacher who enabled the process profits both from the empowerment of the student and from the increase of the motivation for the meaningful learning of physics. This fact is known in the literature in which physics teachers are recommended to adopt teaching approaches that created enjoyment in the class and thus the learning will be effective and efficient. Teaching physics so that it will spark interest and curiosity may contribute to the understanding of the topics learned and the entire learning process (Guido, 2018). A class in which the students enjoy, are interested, and are curious will learn better and will attain higher achievements that will lead the teacher to satisfaction and enjoyment. It is possible to learn from the collection of examples that the teachers brought from their classes that there is a relationship between the teachers' perceptions of their role as effective teachers and the effectiveness of the learning and interest the physics students feel.

To summarize the topic, it is possible to generalize that the changes that occurred in the class were caused by the teachers' change of their conception of their role in teaching. They shifted the focus from the content they teach to the way in which they teach and to the experience that they create for their students (Buabeng et al., 2018). The change in the ways of teaching created an improvement in the class climate and brought many more students closer to the studies of physics. The increase in the number of learners was also

found in a longitudinal research that accompanied the PLCs. The research indicates that since the start of the activity of the professional communities of physics teachers, the number of high school students who chose to learn physics increased substantially and is continuing to increase steadily. In other words, the participation in the professional learning community created among the physics teachers a change in approach that caused a change in the classes, and as proof the number of students of physics increased, the way of teaching, the strategies, the approaches, and the atmosphere in the class changed (Levy et al., 2020). If we remember that the professional learning community strives to advance teaching practices in order to improve the student's achievements, then it is not surprising that the research findings indicated the change in the teachers' thinking patterns and a dramatic increase in the academic achievements of the teachers' students (Darling-Hammond et al., 2017; Marzel & Arica, 2021).

5.5 Summary

At the start of this chapter, the discussion was presented for each one of the research questions separately. Now we take a general look at the main points as they arose in the discussion and the findings of this research study. We will summarize in short the picture that is reflected from all four of the research questions, with the categorization of the main characteristics.

Coming to the Community

- Most of the physics teachers come to the community out of a social need and less because of a learning need.
- The creation of relationships with colleagues enables the exchanges of information and creates mutual responsibility and a feeling of a partnership along the way.
- The power that a community has is stronger by far than the power of a single teacher and a "teachers' room for physics" is created, which enables the professional and pedagogical sharing of ideas.
- The social learning is a "power multiplier" that greatly strengthens the feeling of professional satisfaction.
- The conversation between the Paris Community teachers creates a feeling of a fine social meeting, in which professional stakeholders speak the same professional language. The learning grows from the reciprocal relationships and the manner of the relationships woven between the community teachers.
- The interaction with other teachers intensifies the feeling that they belong to a group that creates knowledge and engages in shared activities, mutual assistance, discussions, and knowledge sharing.
- In the community, there is a process of the creation of knowledge and not only the receiving of knowledge. The collective strength enables the creation of precise contents for the topics relevant to the teachers. The source of the knowledge and the source of the power are the teachers themselves.
- The teachers learn from one another, strengthen their feeling of self-efficacy, and feel that they contribute and are contributed to at the same time.

- The environment enables the improvement of the knowledge in physics and in the teaching of physics, through the creation of a culture of learning and shared deliberation, when the teachers themselves are the source of the knowledge.
- The community creates belonging to the place in which there is the creation of knowledge, partnerships, friendships, and improvement of the practice through mutual cross-fertilization.
- The physics teachers generally are single teachers in the school in their field. Hence, the feeling of partnership that the community members have, since they are a part of something larger than the single individual. This multiplies energy for the activity of each and every teacher individually. The significant advantage is that each individual teacher brings with him different knowledge and with shared forces the collective knowledge of the community is formed.
- The community contents influenced the teachers' pedagogical perception. The professional change created a feeling of progress, renewal, and growth. New structuring was created of the professional knowledge in the diversification of ways of teaching and acquisition of new skills.
- Pride of the unit was created, which provides solid support with esteemed colleagues whose strength is that they are a group and not individuals in the battle. This is an excellent platform for the improvement of the personal pedagogical knowledge of each teacher and the collective knowledge of the group.
- The feeling of partnership towards the colleagues, the profession, and the shared goals is an internal feeling of identity and belonging, since the teacher is a part of the great whole and the whole is greater than the sum of its parts.
- The experience of learning is influenced by the community culture in which the teachers come with enjoyment to the meeting and are happy to learn from one another. The experience of the meeting contributes to the learning. The teachers create knowledge and build new teaching and more precise processes. The experience of learning is a result of the cohesion between the community teachers that creates mutual commitment and shared responsibility.
- The professional development is perceived by the teachers as a means for the improvement of the students' learning experience and achievements.

- The perception behind the idea of the PLC breaks the paradigms in learning and requires the teachers to be active in the process.

Learner-Focused Teaching

- The experience in the community with clinical learner-focused teaching strengthens the teachers' abilities in the providing of their students' different needs.
- Learner-focused teaching is the theme that connects between the teacher, the student, and the learning material, and its objective is to adjust the teaching method to be correct for each one of the students.
- The teachers examine with their colleagues their teaching and their students' learning, in order to advance innovative teaching ways suited to the specific difficulties of each one of their students.
- The teachers acquire new skills for the creation of conceptual understanding for their students. To establish change in the class, it is necessary to focus on the teachers' approach to the implementation of innovations, diverse teaching methods, and learner-focused learning environments.
- In-depth thinking, rich discussions, and reflection lead to change of the teachers' perception and shaping of their professional identity. Thus, it becomes possible to assimilate learner-focused contents gradually and the change in the teaching slowly and persistently penetrates.
- The teachers perform reflection on the effectiveness of the changes they performed in their practice and ascertain that the changes indeed advance their students' learning.
- The teachers link between the scientific content and the innovative learner-focused teaching approaches.
- To create a study environment that promotes learning, the teaching of physics requires a change of paradigm. It is necessary to shift the focus from learning through practice and memorization to pedagogical development that supports inquiry learning, creation of conceptual understanding, and skills of analysis.
- The fan approach, in which the knowledge comes from above and goes down, has become collaborative learning through the change of roles. A network model developing in three directions of flow has been created. There is diffusion in the

transmission of knowledge between the community teachers and the Weizmann Institute. This dynamic model enables the advancement of learner-focused teaching.

- As the exposure and use of the teaching processes increase, the teacher who learned them will continue to deploy them in the classroom over time. These innovations are reinforced and become routine.
- The learning in the community of physics teachers advances the implementation of learner-focused teaching strategies. The continuous exposure to innovative teaching methods awakens the teachers from stagnation in old and familiar practices and brings freshness to the classroom.
- The use of ritual erodes old work practices and enables to become accustomed, meeting after meeting, to new skills. These will enable the assimilation of innovative and learner-focused teaching approaches and long-term changes in teaching.

Students' Learning

- The changes that occurred in the class were caused by the teachers' change of the perception of their role in teaching. They shifted the focus from the content they are teaching to the way in which they are teaching and the experience they are creating for their students.
- The teachers are the main factors in the students' learning. There are many students whose teachers are undergoing a continuous process of change in the ways of teaching following the learning in the community. The change of perception of the physics teachers will effectively permeate the class and the students.
- The success of the learning among the students derives from conceptual changes that the teachers themselves experience as learners in the PLC.
- The change in the class climate depends on the change in the teaching abilities that the teacher feels. The teachers reported a feeling of improvement in their students' learning experience as a result of the improvement of their teaching experience.
- When the students are active, present films and toys, they themselves create knowledge and thus make the lesson enjoyable and intriguing. A class in which the students enjoy and are interested and curious will learn better and will attain better achievements that will lead the teacher to satisfaction and enjoyment.

- The advancement of the teacher's processes of understanding and diversification in the ways of teaching creates in the class increasing interest in physics, increases the motivation to learn, and improves the interaction between the student and the teacher.

Shared Learning

- The community teachers open the door to their classroom and share with their colleagues the quality teaching materials and successful activities they developed.
- The experience of collaborative learning and the creation of a "teachers' room" for mutual cross-fertilization and the combination of strengths empower the feeling that the teacher is a part of a community with a shared goal.
- The continuous, shared, and long-term learning created professional growth, a support network, confidence in the group's strength, and the desire to learn from one another's experience.
- The interaction with colleagues whose professional experience is appreciated enriches the teachers and increases their self-confidence and sense of partnership along the way and thus creates a learning community.
- Conversation with other teachers synchronizes and enables the exchange of experiences and the development of knowledge.
- The teachers themselves are the learners, learning from one another and from the instructors. Thus, the opportunity is created for them to strengthen their sense of self-efficacy and belief in their ability.
- The teachers hold a reflective conversation on their teaching and on their students' learning and thus contribute to changes in their traditional teaching practices. In the reflective conversation, the teachers provide an interpretation to their colleagues' professional work through the collective examination of the students' learning.
- The meeting of partners in the same profession enables mutual cross-fertilization and exchanges of information, through self and professional empowerment that leads to expertise in teaching.
- Teachers sometimes use processes only after they have attempted them in the community a number of times and have acquired full confidence in their ability to integrate them in their teaching routine. Sometimes they are skeptical and prepared to

make the attempt only after they have heard from their colleagues in the community how much the deployment in the classroom was successful.

- When there is cooperative learning in which the teachers sit together and build knowledge, the assimilation of the new contents is better and continues over time.
- The community enables reflective investigation of the teaching for the purpose of the advancement of shared values, change of practices, and creation of enthusiasm, desire, and sense of identity from the teaching of physics. It reveals different perspectives and creates mutual cross-fertilization and cooperation through learning based on the authentic testimonies that the teachers present from their classes.

Teachers at the Start of Their Path

- Young teachers need to re-examine their ways of teaching and the community is a place that shapes the professionalism, the environment provides an answer to their changing needs and even changes according to their personal needs.
- Experienced and new teachers share with one another the insights and difficulties. The very reflective discourse in the community about the teaching already creates improvement in the teaching.
- The contents in the community build the professional backbone for the process of learning of new teachers – as teachers who are more attentive to students and aware of the difficulties in the teaching of physics.
- The dynamics between the experienced teachers and the new teachers can stop burnout and create a feeling of freshness among the experienced teachers and learning among the new teachers. The two sides benefit and develop professionally.
- The human richness creates variety and productive discourse that provides a solution and strengthens the new teachers' self-confidence.
- When experienced teachers and new teachers work together, they share ideas, motivate one another, and cross-fertilize one another.
- In the community new teachers share their concerns, experienced teachers contribute from their experience, the instructors present the voices of the experts in areas of education, and together they create an atmosphere of change that facilitates the teacher's practice.

- Teachers share with one another the activities they already carried out in their classrooms and bring up insights. Experienced and new teachers present their personal viewpoint and everyone learns from everyone. The influence of the collaborative knowledge anchored in the data exposes to the young people different approaches in teaching. The discussions and the conversations are meaningful and powerful tools for them for the purpose of the structuring of knowledge in physics.
- The continuous process of learning produces changes in the ways of teaching, and new teachers are transformed from passive participants to members of the community who are involved in contents, knowledge, and social interactions.

5.6 Research Contribution

The uniqueness of this research study is that it opens the classroom door of the Paris Community and enables the characterization of the community's teachers' perceptions and feelings, as well as the interaction between them. According to Gilad (2001) and Little (2002), their perceptions primarily address questions, such as how is it appropriate to teach certain topics? How should the students learn? According to Borko (2004), McLaughlin and Talbert (2001), and Waldman and Blonder (2020), the teachers come to the community in order to examine methodically their practice and professional knowledge, so as to improve their ways of teaching. With specific reference to physics according to Eylon and Bagno (1997), the learning in the professional community is intended to advance the studies of physics and to create a dynamic, innovative learning environment that sparks inspiration among the students. The community meetings are held as a friendly and warm meeting of work colleagues, who are guided by their desire to improve. Since generally the physics teachers are alone in the school, through the community a "teachers' room" is created, which is a team on the regional level (Eylon, 2008; Eylon & Bagno, 1997).

The process of learning in the community necessitates the examination of the manner of integration between the content and the process. This research study proposes a different look on the analysis of the group interaction that sheds light on the complex

relationship between the content, the process, and the learning. The present research study has a theoretical contribution and a practical contribution.

Theoretical Contribution

The present research study was not intended to examine new theories but rather to make use of the existing infrastructures of a learning community of teachers for the characterization of the processes of change that the physics teachers undergo during their participation in the PLC. There is simultaneous development of the content world and the community culture. The teachers improve the knowledge in physics and the knowledge in the teaching of the physics, through the creation of a culture of learning and shared deliberation (Little, 2002; Michaeli & Sommer, 2014).

In the context of the teachers' learning, the unique contribution of this research study pertains to the identification of the effectiveness of the community from the teachers' perspective. Here there is a special opportunity to look as an observer from the side on what is happening inside the community. The analysis of the teachers' thoughts, perceptions, and expectations is a look into the inner workings of the Paris Community. If we maintained, like Bagno et al. (2021), that the main goal of the teachers' coming to the community is the learning of new strategies and contents for the diversification of the teaching, then this research study went and proved that the first goal is social and not scholastic. Teachers come to the community to be found in the company of other physics teachers who speak the same professional language (McLaughlin & Talbert, 2001).

This research study shed light on the surprising fact that the meaningful part for the teachers in the learning community is not the learning but the social encounter. Therefore, the theoretical contribution of this research study lies in the identification and understanding of the processes of learning in the community, which create a change in the practices of traditional instruction (Dogan et al., 2016). This contribution enabled the findings of the present research study to be connected to the theory and the considerable importance of the social meeting to be brought to the awareness. The learning grows from the reciprocal relationships and social connections between the Paris Community teachers through the creation of a community experience and sense of partnership along the way

(Eylon et al., 2020). It is important that the decision makers on the topic of the learning communities in physics take into consideration this fact when planning and designing the structure of the meetings. The insights presented in this research study add knowledge to previous research studies that engaged in the dynamics between the PLC teachers and the teachers' active learning.

Practical Contribution

The cross-referencing between the learning characteristics of the community teachers, the changes in the practice, and the influence on the students' learning enabled the examination of the consistency between the learning in the community and the way it is realized in the classrooms. It also enabled the follow up after the physics teachers' processes of professionalization, the characterization of the practice of the professional learning/research community as a whole composed of individual teachers who nurture one another in such a way that the whole is greater than the sum of its parts (Marzel & Arica, 2021). It also enabled the presentation of the culture of the community as a space for dynamic, meaningful, and multidimensional discourse and learning (Darling-Hammond et al., 2017). Because of the low number of research studies that examine the dynamics of the processes of discourse and interaction that spark the growth of learning as well as the way of reflection of the group learning as practice that the teachers lead in their classes, this research study may contribute in a number of dimensions.

The learning and knowledge of teachers in the PLC are dynamic and depend on variables that are not academic, such as social interactions. The learning with the colleagues causes them to grow from a place of a partial and passive participant to a place of a full and active participant (Eshchar-Netz & Vedder-Weiss, 2021). Hence, there is increased importance in the understanding of the characteristics that shape the community teachers' social and learning experiences. The insights that arose from this research study empower the knowledge about these characteristics and shed light on the tapestry of the relationships forming in the community and the types of learning created as a result. These insights may help those who engage in the teachers' professional development to design and plan in-service training courses commensurate with the needs arising from the field.

Thus, they may promote learner-oriented instruction that will influence the students in the classes and leverage the improvement of the quality of the teaching and the climate in the class since, according to Caena (2011), the teachers are the central factor in the students' learning.

5.7 Implications from the Research and Recommendations

The research findings confirm that the biweekly meetings, month after month, year after year, caused the innovation of the teaching ways following the exposure to diverse teaching methods. The teachers reported that the activities they experienced contributed to the change of their traditional teaching perspectives and to a feeling of professional growth. The change of the teachers' pattern of thinking created a change in the classes and a rise in the achievements of teachers' students was seen. It is necessary to understand the implications of the participation in the physics learning community and the tremendous importance of the continuation of the existence of the communities. The following improvements may promote the teachers' learning processes:

The Field of the Development of the Physics Professional Learning Community

The difference between the teachers constitutes a main component that can strengthen the learning in the context of the community of learners. The diverse group exposes the participants to the different experience and knowledge of each one of them and creates pedagogical sharing of ideas. The assumption that led to the creation of the learning community was that the composition of such a group will enable exposure to different paradigms and ways of teaching, will promote the conversation on physics and on the teaching of physics, and therefore will empower the learning. The findings of the present research study indicate that the pedagogical outlooks of the community members developed during the interactions with others to the direction of learner-focused teaching and the creation of an experiential climate that sparks learning.

On the basis of these findings and with the support of the theoretical ideas, it is recommended that the physics teachers persevere in their participation in the professional

disciplinary communities. In addition, it is recommended that activities in the academic part enable in-depth discussions, cooperation, and active learning. Furthermore, in light of the findings of this research study, which discovered that the social need is important for the physics teachers more than the academic need, it is recommended to design in an intelligent manner the community meetings. It is necessary that a regular time be allocated, and not incidental discourse between activities, for sharing dilemmas, seeking advice, and creating a teachers' room on the regional level.

The Field of Collaborative Social Learning

Most of the physics teachers are alone in their schools, and the community creates for them a support group for professional knowledge and pedagogical knowledge. The number of meetings a year is limited, and every meeting is filled with contents, so that it is not possible to have sufficient conversation about personal dilemmas. During the meeting, they experience new strategies, analyze their students' learning, and posit insights, but there is not enough time to discuss the rest of the topics that bother them. The findings of the present research study indicate that the teachers are thirsty for a connection even after the hours of the community activity. They want to share insights from the lesson that was held now, and it is hard for them to restrain themselves until the next meeting. On the basis of these findings, and with the support of the theoretical ideas, it is recommended to create an online platform that will be an accessible means of communication, such as a community WhatsApp group. On this platform, the teachers can share insights immediately after they occur, send an interesting picture or film clip they found, and ask questions. There is added value in the rapid transmission of knowledge that enables group communication without the need to wait two weeks until the next community meeting.

5.8 Research Limitations

The objective of the present research study was to examine the learning characteristics of physics teachers' learning communities from the perspective of the teachers who are participating in the Paris Community. The results of this research study reflect considerably the quality of the relationships created between the community teachers and the instructors and the interaction among themselves.

The first limitation derives from the fact that the research addresses only one community and therefore its ability to generalize is limited. In this way, it is not possible to follow up after the dynamics of the group learning in all the rest of the districts and it is possible that in other communities, which are different in their human composition, a different conversation and different interactions would have occurred.

The second limitation derives from the fact that the research study addresses only the community teachers and the voice of the physics students is heard only through their teachers. In this way, it is not possible to follow up after the insights of the students whose teachers are exposed in the community to innovative knowledge processes. It is possible that observations in the Paris Community teachers' classrooms would change the research conclusions about the changes that occurred in the classes.

A third limitation derives from the fact that the researcher observed, participated in, and was a part of the Paris Community. She was one of the community leaders. Qualitative research in which the researcher undergoes the experiences of the group she researches entails the risk of bias in the interpretation of the findings.

Although I adhered to all ethical and professional standards and although I carried out actions in order to maintain the research reliability, I am aware of the limitations reviewed above and also that the analysis of the discussion from a different theoretical perspective of the analysis of the testimonies of teachers in another community might yield other conclusions and even delineate another picture of the physics teachers. I am aware that these limitations have implications on the tentative nature of the knowledge I produced and the transferability of the conclusions I reached.

5.9 Suggestions for Further Research

This research study focused on the teachers of the Paris Community. The interactions between the teachers, the collaboration, and the social relationships formed were examined. The influence in the class following the teacher's participation in the community was also investigated.

The present research study did not emphasize who shares the materials in the community. Is this only the leaders? Is this only the experienced teachers? Do new teachers share or are they afraid of criticism?

It is recommended to carry out an in-depth research study that will focus on the separation between the voices in the dimension of the content. Such a research study will map the collaborations in quantitative terms. Do the experienced teachers share the learning materials? Do the young and technological teachers share innovative teaching techniques? The use of Internet platforms? Which teachers contribute more to the community? Do the instructors share materials they developed themselves? Which teachers provide feedback on the activities of other teachers?

This continuation research will add another layer to the present research study, since it will help determine the type of teachers who contribute to the community. Furthermore, it will shed light on the factors that influence the collaboration.

The present research study did not examine the students' voices and relied on the teachers' reports about their classes. It is therefore recommended to enter the classrooms of the Paris Community teachers and observe their students. It is recommended to carry out a continuation research study that will follow up on the changes of climate in the classroom, following the change of the approach of the teacher who experienced professional development in the community. Since information on this topic is lacking today in the professional literature, it is recommended to continue to research the students' learning in order to shed light on the indirect influence occurring in the classrooms.

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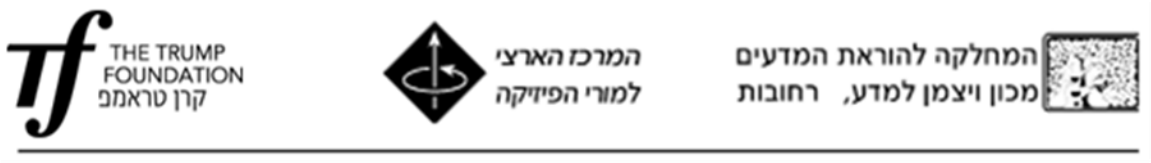
Appendices

Appendix A: End Task of the Year of Activity in the Communities

Translation of year-end assignment



Physics Teachers Community "Close to Home"

Annual portfolio

In order to receive a reward with a grade, a portfolio must be sent until the graduation meeting. The portfolio will document the process we went through this year.

The structure of the portfolio

1. An opening page that includes the name of the teacher's community, teacher's name, teacher's ID number, the names of the instructors and the training symbol.
2. Table of Contents.
3. "Who I am" - an introduction in which you will tell a little about yourself, where you teach,

   How many years of physics teaching experience do you have? your professional worldview,

   How many years have you been a member of the "Close to Home" physics teacher community?

4. **Research-based activity - a detailed description of the activity and the development process:**

- Names of group members
- The goals of the activity and the rationale behind it
- Were there any dilemmas in the group? Strive to elaborate on the decision-making process and considerations in the group in choosing the topic and type of activity.
- Description of the activity (including diagrams and photos)

- Didactic guidelines: For which stage in the teaching is the activity suitable, for which students the activity is suitable, the length of time required, the equipment and so on. (Anything that can help a fellow teacher experiment with his students successfully).
- Conclusions and reflection from the activity development process. Try to elaborate.

5. **Evidence from the classrooms for research-based activities and projects** - Description of the activity / project, method of transfer, students' reactions, conclusions and insights, etc.
6. **A toy, demo or video that you have adopted in your physics classes** - A brief description what were your considerations when you chose to adopt and students' reactions?
7. **A collection of findings from the classrooms** documenting the experiences during the year in the context of pre-learning teaching, such as: analysis of students' work, documentation of the implementation of the various teaching strategies, pictures, etc.
8. **Summary and Reflection** - What are the main things you learned this year? What happened to you as a result of your participation in the community? What happened to your students? Please detail and share as much as possible.
9. **Sources:**

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קהילת מורי הפיזיקה "קרוב לבית"

תיק עבודות מסכם

לצורך קבלת גמול עם ציון, יש לשלוח **עד מפגש הסיום** קובץ ובו תיק עבודות שיתעד את התהליך שעברנו השנה.

מבנה התיק

1. דף פתיחה הכולל את שם קהילת המורים, שמכם, מספר הזהות, שמות המנחים וסמל ההשתלמות.
2. תוכן העניינים
3. "מי אני" – הקדמה שבה תספרו קצת על עצמכם, היכן אתם מלמדים, מהו הוותק שלכם בהוראת הפיזיקה ותפיסת העולם המקצועית שלכם. כמה שנים אתם חברים בקהילת מורי הפיזיקה "קרוב לבית"?
4. **פעילות מבוססת חקר – תיאור מפורט של הפעילות ושל תהליך הפיתוח:**
   א. שמות חברי הקבוצה
   ב. מטרות הפעילות והרציונל העומד מאחוריה
   ג. האם היו התלבטויות בקבוצה? השתדלו לפרט לגבי תהליך קבלת ההחלטות והשיקולים בקבוצה בבחירת הנושא וסוג הפעילות.
   ד. תיאור הפעילות (כולל תרשימים ותמונות)
   ה. הנחיות דידקטיות: לאיזה שלב בהוראה מתאימה הפעילות, התלמידים שלהם הפעילות מתאימה, משך הזמן הנדרש, הציוד וכדומה. (כל מה שיכול לסייע למורה עמית להתנסות עם תלמידיו בהצלחה).
   ו. מסקנות ורפלקציה מתהליך פיתוח הפעילות. השתדלו לפרט.
5. **עדויות מהכיתות לפעילויות מבוססות חקר ופרויקטים** – תיאור הפעילות/הפרויקט, אופן ההעברה, תגובות של תלמידים, מסקנות ותובנות וכדומה.
6. **צעצוע, הדגמה או סרטון שאימצתם בשעורי הפיזיקה שלכם** – תאור קצר, מה היו השיקולים שלכם כשבחרתם לאמצו ותגובות של תלמידים.
7. **אוסף ממצאים מהכיתות** המתעדים את ההתנסויות במהלך השנה בהקשר של הוראה מקדמת למידה, כגון: ניתוח עבודות תלמידים, תיעוד הפעלת אסטרטגיות הוראה שונות, תמונות וכדומה.
8. **סיכום ורפלקציה** - מהם הדברים המרכזיים שלמדתם השנה? מה קרה לכם בעקבות השתתפותכם בקהילה? מה קרה לתלמידים שלכם? אנא פרטו ושתפו ככל האפשר.

9. **מקורות:**

- זוהר, ע' (עורכת). (2007). למידה בדרך החקר : אתגר מתמשך. ירושלים : מאגנס.
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- Wenning, C. J. (2005). Levels of inquiry: Hierarchies of pedagogical practices and inquiry processes. *Journal of Physics Teacher Education Online, 2*(3), 3-11.

Appendix B: Informed Consent Form

Informed Consent

Study: Physics teachers learning communities- from the perspective of teachers.

The purpose of the study is to examine and gain insight into teacher's perspective about correlation between the students' achievements and the fact that their teachers learn in communities. Another aspect of this study on teachers is whether or not they view their participation in a professional learning community as an opportunity that promotes and encourages professional development.

The purpose of this document is to specify the terms of your participation in the study. Daphne Cohen Brenner doctoral student under the supervision of prof, Dr. Hab. Stanisław Dylak, is requesting your participation in a research study entitled, Physics teachers learning communities- from the perspective of teachers.

If at any time during the study you are uncomfortable answering any of the questions, please feel free to decline a response or stop the interview or the observation. The design of the study has been created to minimize the risk to any participant.

The findings of such a study would contribute to the field of education by creating a more effective and beneficial professional growth plan for teachers. The insight obtained through this research could also provide vital information addressing the need for continuous teacher education.

The results of the study will be published in my dissertation however; the names of the participants, the school, and the school district will not be revealed in the study.

For the purpose of the study, pseudo names will be assigned by the researcher to the school, school district, and all participants. Names will not be revealed by the researcher at any time. All transcripts and data collected will be kept in a secured area available only to the researcher.

Any questions about the study should be referred to Daphne Cohen-Brenner or prof, Dr. Hab. Stanisław Dylak, Email addresses are listed.

Your participation in the study is voluntary and will not be compensated. At any time during the study you are free to withdraw from the study. During the interview, I will ask general questions about your participation in a professional learning community. For documentation purposes, I will take notes during the interviews and will ask permission to record (by audio/video tape) our conversations. There are no right or wrong answers to the questions that will be asked.

Your impressions, reflections, and thoughtful answers are very important to the study.

THE TRUMP FOUNDATION
קרן טראמפ

המחלקה להוראת המדעים
Department of Science Teaching

ADAM MICKIEWICZ UNIVERSITY IN POZNAŃ
Faculty of Educational Studies

Participant's Permission

I have read and understand the Informed Consent and conditions of this Study. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent:

_____Date_____

Participant's Signature

Should I have any questions about this research or its conduct, I may contact:

Daphne Cohen-Brenner – (0509515421) – daphnecohenb@gmail.com

_____Date_____

Researcher's Signature

EXAMPLE OF SIGNING A STUDY PARTICIPATION AGREEMENT

Appendix C: Transcript of Interviews with Community Members and Andrei

תמלול ראיונות עם חברי הקהילה ואנדריי

הראיונות בוצעו בתאריך 2021/7/20 ותומללו באותו יום. כל קטעי הקול נמצאים בקישור:

https://drive.google.com/drive/u/1/folders/1v1E2uBZsYpX0whfoAc4V7eP3-YD-d-mD

Interview with Emily — תרגום הריאיון עם אמילי

Daphne: What I'm asking you is not necessarily about this year, it's in general.

Emily: I am ready to say about the previous years and the coming years and everything you want to ask.
Daphne: Especially previous years, when the community was real and we met face to face and not zoom. **Question 1** - What are the perceptions of physics teachers regarding professional learning communities? I mean what do you actually think or know about a professional community. Even before you came [to the community] what did you think of it? And even after you are already in the communities. I mean even before you came if you even knew anything about it? And even now after being in the communities for so long. What do you think of this concept called a professional learning community?

Emily: Before I came I had no idea what it was, I did not know and I did not understand what it is good for? I could not imagine either. Because I was already a veteran teacher and already pretty much knew everything. So before I came, I really did not believe it. But after I arrived and I've been here for a few years in the community, I can say that it's amazing. First of all, it directs me and sharpens all sorts of special points that are not entirely clear in matter [in physics]. All sorts of little points that I thought were perfectly clear. All kinds of activities, say like we did then on friction force. I was sure I already knew everything about friction force. But still I heard one teacher say so and another teacher say so. And all kinds of activities that are done to refine in the community. Even the experiment of the spring we did in " thought-provoking laboratory", I was convinced that it was simple, that I know everything about it, and yet I learned new things and it sharpened new and different things for me. This is from my personal point of view the refinement.

Generally, it links me to supervision. It arranges for me a refinement of points regarding the matriculation exam and regarding the focus of the matriculation exam which is something that is really important to me.

Daphne: **Question 2** - What activities and strategies do teachers engage in classrooms after acquiring them in communities? That is, we learned about demonstration with the help of videos, about incorporating toys in teaching, about new teaching strategies. So what do you think as a teacher, because you cannot talk about others, what did you acquire in the community and do in class?

Emily: I personally always like after I'm in the community, to take the videos that show in video time or a photo from photo time and then I take them to class if it's related to my study material and it's really great.

The kids in the class always ask me on Wednesday: What were you not in the community yesterday? How can it be that you do not have a video or something new? When we would meet regularly on Tuesdays, the kids would always ask me the next morning: There was no community yesterday? We do not have a video to watch? So I always take the videos especially when they are related to me to material or jokes that you bring up sometimes, or pictures and sometimes I use labs. For example, this year I did the spring lab. Last

year I did the thin battery and voltage, which we did in a thought-provoking lab with Alex. And I did it in class with them. So I always take one of the suggested labs, to class, to try it out.

Daphne: And what about strategies like ". P.O. E" or "Give a minute to think" or diagnostic questionnaires?

Emily: I do less teaching strategies because I am very confident in my frontal teaching. I use strategies less; I use my instincts more. It's because I'm a veteran and I have a lot of experience, so I do it less, if anything, I'm trying to bring something new to the class so I bring labs or videos or things they've never seen.

Daphne: **Question 3**- What do you think is the benefit of being a member of a learning community in physics? **Emily**: A huge benefit. First **All the people in the community face the same problems with me on a daily basis. Everyone gets up in the morning and does exactly what I do. It's rare to find. Being a lone teacher in a school or at most with another teacher, because in physics there is usually a small team. So this thing is a power multiplier. Really power multiplier**.

133 Another thing is that if I have any problem or I am having some difficulty, I have somewhere to bring
134 that difficulty. Whenever I tell kids I'll check it out, then I mean I'll come to the community and I'll ask.
135 This is something that helps me a lot. Another thing, I get like we said tools, videos, labs and new
136 things to do. These are the three main things.

Daphne: Question 4 - Do you think community participation has improved student learning in the classroom? In terms of interest? In terms of relevance? Have we suddenly become more relevant? More interesting? Maybe even the achievements have been improved? Has the number of students increased? Anything you think it could have thrown at the class.

Emily: For me, as I told you before, the children always on Wednesday morning would ask me what was not a community yesterday? As if the kids are already waiting for me to come up with things from the community. That's one thing. They are always waiting for something new to come from the community and we are talking about the community. I tell them I'm part of a teacher community and I feel it instills confidence in them. Other than me I have another academic back. I have more people with me. Both from the supervisor and from the other teachers in the city who are also participants in this community. I think the kids feel very confident about it. I have such a feeling that they have a kind of relief that it's not just me and them in class.

Daphne: Is there anything else related to questions and related to communities that I did not think of, that you would like to tell me?

Emily: We had two mentors. Welcoming and courteous. It's part of this interest, courtesy and feeling that I'm glad I'm coming. It really feels awfully good. I'm not just saying this on my own behalf in the name of all the people in the community from the most disgusting person there to the most charming person there. The beautiful and pleasant hospitality is equal to everyone and it really is an amazing thing. I do not think I myself would have been able to do that. Who like you Daphne, knows this…

ראיון עם אנדריי - Interview with Andrei

דפנה: שלום אנדריי עד עכשיו הספקתי לעשות ראיון עם אמילי ועם **קרינה** ועכשיו אני צריכה לעשות ראיון אתך.
אנדריי: פנטסטי קדימה.
דפנה: אז אני מכוונת אותך דרך ארבע שאלות ואחר כך תגיד מה שאתה רוצה. אנחנו מדברים על השנים בהם אני ואתה היינו בקהילה. כמובן לא על שנים שבהם נפגשנו בזום אלא רק שנים בקהילה רגיל
אנדריי: אוקיי
דפנה: שאלה 1 - מה התפיסות של מורים לפיזיקה לגבי קהילות למידה מקצועיות? זאת אומרת, מה מורה שהגיע לקהילה, מה אתה חושב שהוא ידע על קהילה לפני שהוא בא לקהילה? ומה הוא חושב על קהילה אחרי שהוא בא? אתה יכול פה לדבר בעיניים של מורה, לא חייב להיות בעיניים של מורה מוביל.
אנדריי: אז אני רוצה לחזור על השאלה. מה הבנאדם ידע לגבי קהילה ומה התפיסה שלו והחשיבה שלו אחרי כמה שנים בקהילה?
דפנה: נכון לגבי הקונספט הזה שנקרא קהילת למידה מקצועית
אנדריי: אוקיי אז לפני שבן אדם מגיע לקהילה הוא בטח שמה פה ושם שקיימת תופעה שנקראת קהילת מורי הפיזיקה. הוא לא ידע בדיוק מה עושים בקהילה וכל מה שהוא ידע זה על קצה המזלג. מגיע אליו שמועה מפה לאוזן. האינפורמציה די דלילה, לא מדויקת ובהתחלה הוא אפילו לא יודע אם כדאי לו או לא כדאי לו להתחבר לתופעה הזאת. אחרי מספר שנים, שנה, שנתיים, שלוש בתוך הקהילה הוא מתחיל להסתכל על כל העניין הזה בעיניים אחרות. קודם כל **שמתי לב שבעצם המורים מחפשים קשר מקצועי זה עם זה.** זאת אומרת כל אחד מהמורים מתבשל במסגרת בית ספר שלו הוא לבד או מקסימום עם עוד מורה או שתיים **ואין לו עם מי להחליף דעות**, אין לו עם מי לדבר, אפילו שהוא מקבל אינפורמציה פה ושם ממשרד החינוך או דרך אתר מורי הפיזיקה, עדיין **הוא מתלבט בקבלת החלטות**. כאשר יש לו קהילה וכבר שנתיים הוא בקהילה ויש לו קבוצת אנשים שהוא בעצם יכול תמיד להרים טלפון, להתכתב בדואר או ב sms או בדואר אלקטרוני **ולקבל תשובה מידית וזה מה שחשוב, תשובה מיידית על כל שאלה שמתעוררת** והוא צריך למצוא את הפתרון. דבר נוסף, פאן חברתי. מורה הוא בן אדם חברתי סוציאלי **הוא מחפש תקשורת** לא יכול להיות מורה שלא מדבר. את זוכרת איך בקהילה, אני כבר אדבר על הקהילה שלנו, מה תמיד עשינו? החלק **הראשון תמיד היה הידברות** כשהם באים, אוכלים יושבים ובלה בלה בלה **וזה החלק הכי חשוב בעיניי** כי כאן בקטע הזה **נוצר הפאן החברתי הזה שהם יוצרים קשרים זה עם זה בצורה אקראית** וזה מה שחשוב. הוא ניגש למי שהוא רוצה, הוא מדבר עם מי שהוא רוצה, מחליף דעות ועוד עם מי שהוא רוצה על נקודות שהוא צריך. אני יושב בצד ואת יושבת בצד וכל פעם שיש שאלה או מתעורר משהו רק אז הם באים אלינו ושואלים אותנו שאלות. רק אחר כך היינו מגיעים לחלק הלימודי, החלק הסידורי. אז במשך שנתיים **הבן אדם מבין שכל פעם שיש לו** הוראה מסוימת ממשרד החינוך והוא עדיין מתלבט ועדיין לא מבין משהו, **יש לו כתובת עם מי לדבר: א. חברים ב. מנחים** והתשובות שהוא מקבל, הן מידית.
דפנה: שאלה 2- אילו פעילויות ואסטרטגיות מורים עושים בכיתות אחרי שהם רכשו אותם בקהילות? זאת אומרת מה מתוך מה שלמדנו: שילוב סרטונים, שילוב צעצועים, מעבדות, שאלונים דיאגנוסטיים, מה לדעתך מורים לוקחים, או אתה כמורה, לוקחים לכיתות ממה שהם הרוויחו בקהילה?
אנדריי: למעשה מורים לוקחים הכל. פשוט כל אחד לוקח בהתאם לצרכים שלו ולאופי שלו. אני אתן לך דוגמא, למשל את ראית שלא פעם אחת הם היו באים אליי לשאלות כי אני הייתי אחד מבין הראשונים שהתחיל להשתמש במקרן לכתיבת טקסטים מול מצלמה עוד לפני הקורונה בכמה שנים. מורים התחילו מיד להעתיק את השיטה הזאת, כמובן רק מי שרצה. אחר כך היינו מדברים על קסמים. את זוכרת כמה קסמים אני הראיתי? מי שרצה העתיק לעצמו את הדברים האלה והיה משתמש. כמה סרטונים הבאנו למפגשים שלנו? סרטוני פיזיקה שאפשר להשתמש בשלב זה בשלב אחר בשלב שלישי. כל אחד היה לוקח את החלק המתאים לו והיה משתמש בשלב שמתאים לו. כנ"ל לגבי מעבדות. דיברנו על מעבדות, דיברנו על מבחנים, דיברנו על תרגילים, דיברנו על בדיקת מבחנים ומה לא? לכן התשובה היא כזאת ש: כן! כל אחד מצא את התשובה שמתאימה לו ולקח מקסימום. זה בטוח. אפשר לראות את זה, אני אתן לך דוגמא את ארקדי. אני מכיר אותו עוד לפני שהתחלנו את הפעילויות בקהילה. הוא בן אדם שהיה סגור במסגרת שלו. היה מתקשר רק עם 2, 3 מורים שאני מכיר אותם גם כן. הוא היה לבד, בודד, ושימי לב כמה הוא התחבר לכל הקהילה. הוא היה מגיע, הוא היה מדבר, הוא היה מצחיק, זוכרת? אז זה בן אדם שהיה לבד לבד והוא פתאום מצא את החן בכל הפעילות הזאת. אז השאלה שלך הייתה, מה הניצול? מה המורים לקחו? התשובה היא שהמורים לקחו מקסימום אבל כל אחד בתחום משלו.

דפנה: שאלה 3- מה התועלת בלהיות חבר בקהילת מורים מקצועית לומדת?
אנדריי: כן, מה אני מרוויח כבנאדם? כמורה? כמרצה מבחינה מקצועית? אני חושב שכבר עניתי על זה, אז **מבחינת החלק החברתי יש לי קבוצת אנשים די מגוונת, די גדולה**, שלמעשה אני יכול **למצוא תשובה לכל שאלה שיש לי**. אם יש לי שאלה בתחום האולימפיאדות? כולם יודעים שצריך לפנות לאנדריי. אם יש לי שאלה בתחום הניירת וחוקים וכל זה? הם יודעים שאפשר לפנות לדפנה. אם יש לי שאלה בתחום התנהלות אדמיניסטרטיבית בבית ספר, כלומר איך להגיב על דבר זה או אחר? הם יודעים שהם תמיד יכולים להתייעץ זה עם זה. זאת אומרת שבקטע החברתי לבן אדם יש תועלת חד-משמעית באופן מאוד גבוה. החלק המקצועי, כנ"ל, גם כן בדיוק אותו דבר. אני למעשה כבר אמרתי בתשובות הקודמות שהיתרון הוא **קבלת תשובה מידית על כל שאלה שמתעוררת תוך כדי עבודה**. אני לא מדבר על זה **שהם מקבלים גמול השתלמות, גם זה יתרון** אולי כדאי לציין את זה?
דפנה: אני לא חשבתי על זה.
אנדריי: לא, לא, זה יתרון כי פשוט הבן אדם מקבל גמול השתלמות וזה לא סתם. יש יתרון חברתי, מקצועי ויותר מזה, אם נשווה למשל לארגון המורים, אז גם שמה יש קבוצה מקצועית ואני יכול לקבל תשובות זריזות על כל שאלה שמתעוררת. אבל זה נורא גדול ורחב ורחוק. הקהילה היא הרבה יותר קרובה. זה גם לא לימוד שיגרתי. לימוד שיגרתי מחייב לשבת ובצורה פסיבית לקלוט, לעבד נתונים ולהיבחן. אבל כאן אפשר לציין **שזה לימוד אקטיבי, כי כל אחד לוקח חלק די רציני בכל מפגש** ואנחנו לומדים, המורים לומדים וזה לא פסיבי, זה אקטיבי. זאת אומרת אנחנו לומדים נושאים רלוונטיים שחשובים לנו כרגע ועכשיו ולא משהו שחשוב באופן כללי בפדגוגיה. אני אתן לך דוגמה שקשורה דווקא לקורונה. אני חייב לפרגן גם למשרד החינוך וגם למדינה וגם לכל המורים שבמשך שנה וחצי, שנתיים שהייתה קורונה, מספר ההשתלמויות היה אינסופי והמורים הצליחו תוך זמן קצר ללמוד דברים רבים, ענקיים. אם נרצה להשוות מורה כפי שהוא היה לפני קורונה ואחרי קורונה זה מורה אחר לגמרי, למידה אחרת, הוראה אחרת. תוך זמן קצר מאוד המורים הספיקו ללמוד והצליחו להתגבר על הבעיה הזאת. זאת התשובה לשאלתך.
דפנה: גם אצלנו בקהילה, אל תשכח שלא רק אני ואתה לימדנו, כל פעם מורה אחר הציג משהו בקהילה.
אנדריי: לזה בדיוק התכוונתי. כן בהחלט. **המורים הציגו כל פעם נושאים שהיו חשובים לפי דעתם** ורלוונטיים לפי דעתם והצליחו לפתח פה משהו גדול. אני זוכר את סברינה שעשתה משהו בתחום שלה והיה מאוד יפה והייתה מצגת מאוד יפה. נזכרתי פתאום שיש לי במעבדה כרזה מאוד גדולה של קהילת מורי הפיזיקה. האם את רוצה אותה?
דפנה: כן. אני אשמח לקחת אותה.
אנדריי: אני אדבר עם הלבורנטית שלי שזה יגיע אלייך.
דפנה: שאלה אחרונה. דיברנו על מה התועלת להיות חבר בקהילה ונשארה לנו שאלה אחרונה, שאלה 4- האם ההשתתפות בקהילה שיפרה לדעתך את הלמידה של התלמידים בכיתות? כלומר האם נהיה להם יותר מעניין? האם נהייה להם יותר רלוונטי?
אנדריי: בוודאי. חד-משמעי, כן.
דפנה: זאת אומרת אני לוקחת עכשיו את השאלה לתוך הכיתה.
אנדריי: לקחת לתוך הכיתה, הבנתי. מה שקרה, המורה שהיה בעבר סגור בתוך הבועה שלו, לימד שנים רבות כמו רכבת על מסילות, אותו דבר כל פעם. ברגע שהוא הגיע [לקהילה] למקור מגוון של שיטות ודרכים ומקורות והכל, **הוא קיבל מאנשים לא רק ידע, לא רק כלים, אלא גם קיבל כיוונים, כיצד לגוון את העבודה שלו**. ברגע שמורה נכנס לכיתה ומגוון במשהו, לא משנה במה, אפילו לוקח תרגיל שמנוסח על ידי מורה אחר ועם תמונה אחרת, זה מספיק. אז התלמידים מרגישים את זה, גם אם לא באופן ישיר אז בעקיפין כן, בטוח. לכן הלמידה של התלמידים הופכת להיות יותר עשירה וכמובן התלמידים מושפעים מכל זה.
דפנה: אתה חושב שזה יכול להשפיע על ההישגים שלהם גם בבחינות?
אנדריי: זה בטוח משפיע על התלמיד. לא עשינו אומנם סטטיסטיקה, כי לא הייתה שאלה כזאת. אבל בוא נגיד אם את עוברת ממורה למורה, מאחד לשני ואת יכולה לעשות איזה שהוא קובץ אקסל ולשלוח למורה..
דפנה: אסור לי לדבר על תלמידים וציונים. אני מדברת על רלוונטיות..
אנדריי: לא, את לא חייבת לדבר על ציונים. לא ספציפית על ציונים. [את יכולה לשאול] האם אתם חושבים שזה משפיע על טובת התלמיד? האם זה מעשיר את הידע שלהם? האם זה מקדם אותם בתחומי הפיזיקה והישגים שלהם? את לא חייבת לדבר על ציונים, את יכולה לשאול שאלות כלליות.
דפנה: כן. שאלות כלליות על כמות לומדים ולא על ציונים.
אנדריי: כן. האם זה עזר לכם לשמור על כמות התלמידים שלא יעזבו?
דפנה: אז מה? אתה חושב שכן? כמו שאמרת?

אנדריי: כן כן.
דפנה: בסדר. זהו אנדריי. ענינו על הכל. יש לך עוד משהו שאתה רוצה להגיד לי על קהילה? אתה חושב שיש עוד משהו שלא חשבתי עליו?
אנדריי: עוד אני רוצה לומר, שבעצם **קהילה לא מחליפה לימודים סדירים של "איך להיות מורה"**. בשביל להיות מורה צריך ללמוד, צריך לקחת תואר ראשון ותואר שני באוניברסיטה. ללמוד ממש איך להיות מורה, עם תכנית לימודים והכל. הקהילה לא מחליפה את זה **אבל היא מוסיפה חד משמעית**.
דפנה: תודה רבה אנדריי.

ראיון עם אמילי - Interview with Emily

דפנה: מה שאני שואלת אותך זה לא בהכרח על השנה הזאת, זה בכלליות.
אמילי: אני מוכנה להגיד גם על השנים הקודמות וגם על השנים הבאות ועל מה שאת רוצה לשאול.
דפנה: בעיקר שנים קודמות, כשהקהילה הייתה אמיתית ונפגשנו פנים אל פנים אז אני אשאל אותך שאלות ואני מכוונת אותך כדי שתדעי מה לענות לי. שאלה 1 - מה הם התפיסות של מורים לפיזיקה לגבי קהילות למידה מקצועיות? זאת אומרת מה את בעצם חושבת או יודעת על קהילה מקצועית. גם לפני שבאת [לקהילה] מה חשבת על זה? וגם אחרי שאת כבר נמצאת בקהילות. כלומר גם לפני שבאת אם בכלל ידעת על זה משהו? וגם עכשיו אחרי שאת נמצאת בקהילות כל כך הרבה זמן. מה את חושבת על הקונספט הזה שנקרא קהילה מקצועית לומדת?
אמילי: לפני שבאתי לא היה לי מושג מה זה, לא ידעתי וגם לא הבנתי בשביל מה זה טוב? גם לא יכולתי לדמיין. כי **הייתי כבר מורה ותיקה וכבר פחות או יותר ידעתי הכל**. אז לפני שבאתי, ממש לא האמנתי בזה. אבל אחרי שהגעתי ואני נמצאת כאן כבר כמה שנים בקהילה, אני יכולה להגיד שזה מדהים. דבר ראשון **זה מכוון אותי ומחדד כל מיני נקודות מיוחדות שלא לגמרי ברורות בחומר.** כל מיני **נקודות שאני חשבתי שהן ברורות לחלוטין**. כל מיני פעילויות, נגיד כמו שעשינו אז על כוח חיכוך. אני **הייתי בטוחה שאני יודעת כבר הכל על כוח חיכוך**. אבל בכל זאת שמעתי מורה אחת אומרת ככה ומורה אחר אומר ככה. וכל מיני פעילויות שעושים לחידוד בקהילה. גם הניסוי של הקפיץ שעשינו במעבדה מזמנת חשיבה**, הייתי משוכנעת שזה כלום, שאני יודעת על זה הכל, ובכל זאת למדתי דברים חדשים וזה חידד לי דברים חדשים ואחרים**. זה מהבחינה האישית שלי של החידוד. מבחינה כללית זה מקשר אותי לפיקוח. **זה מסדר לי חידוד של נקודות לגבי הבגרות** ולגבי המיקוד של הבגרות שזה משהו שממש ממש חשוב לי.
דפנה: שאלה 2 - אילו פעילויות ואסטרטגיות מורים מפעילים בכיתות אחרי שרכשו אותם בקהילות? כלומר נגיד למדנו על סרטונים על שילוב צעצועים על אסטרטגיות, אז מה לדעתך או את כמורה כי את לא יכולה לדבר על אחרים, מה את רכשת בקהילה ואת כן עושה בכיתה?
אמילי: אני באופן אישי אוהבת תמיד אחרי שאני בקהילה, לקחת את הסרטונים שמראים בפינת הסרטון או תמונה מפינת התמונות ואז אני לוקחת אותם לכיתה אם זה קשור לי לחומר הלימוד וזה ממש נהדר. תמיד הילדים בכיתה שואלים אותי ביום רביעי: **מה אתמול לא היית בקהילה? איך זה יכול להיות שאין לך סרטון או משהו חדש?** כשהיינו נפגשים באופן קבוע בימי שלישי, תמיד הילדים בבוקר למחרת היו שואלים אותי: מה אתמול לא הייתה קהילה? אין לנו סרטון לראות? אז אני תמיד לוקחת את הסרטונים במיוחד כשהם קשורים לי לחומר או בדיחות שאת מביאה לפעמים, או תמונות ולעיתים אני משתמשת במעבדות. למשל השנה עשיתי את הקפיץ. שנה שעברה עשיתי את כאם ומתח הדקים שעשינו במעבדה מזמנת חשיבה עם אנדריי ואני עשיתי את זה בכיתה איתם. **אז אני כל פעם לוקחת את אחת המעבדות המוצעות, לכיתה, כדי לנסות את זה**.
דפנה: ומה עם אסטרטגיות כמו POE או תן דקה לחשיבה או שאלונים דיאגנוסטיים?
אמילי: אני פחות עושה אסטרטגיות של הוראה, כי אני נורא סומכת על ההוראה הפרונטלית שלי. אני פחות משתמשת באסטרטגיות, אני יותר משתמשת בתחושות הבטן שלי. זה בגלל שאני וותיקה ויש לי ניסיון גדול, אז אני פחות עושה את זה, אני מנסה אם כבר להביא משהו לכיתה אז להביא מעבדות או סרטונים או דברים כאלה שהם לא ראו אף פעם.
דפנה: שאלה 3- מה התועלת לדעתך בלהיות חבר בקהילת למידה בפיזיקה?
אמילי: תועלת ענקית. דבר ראשון **כל האנשים שנמצאים בקהילה, מתמודדים יחד איתי באותן הבעיות היומיומיות שלי.** כולם קמים בבוקר **ועושים בדיוק את מה שאני עושה. זה נדיר למצוא. בהיותי מורה בודדה בבית ספר** או מקסימום עם עוד מורה נוספת, כי הרי בפיזיקה יש צוות קטן בדרך כלל. אז **הדבר הזה הוא מכפיל**

כוח. ממש מכפיל כוח. דבר נוסף הוא שאם יש לי איזה שהיא **בעיה או שאני נתקלת באיזה שהוא קושי, יש לי לאיפה להביא את הקושי הזה**. תמיד כשאני אומרת לילדים **שאני אבדוק את זה**, אז אני **מתכוונת לזה שאני אבוא לקהילה ואני אשאל**. זה משהו שמאוד עוזר לי. דבר נוסף, **אני מקבלת כמו שאמרנו כלים, סרטונים, מעבדות ודברים חדשים לעשות**. אלה שלושת הדברים העיקריים.

דפנה: שאלה 4 - האם השתתפות בקהילה שיפרה לדעתך את למידת התלמידים בכיתה? מבחינת עניין? מבחינת רלוונטיות? שהפכנו פתאום להיות יותר רלוונטיים? יותר מעניינים? אולי אפילו הישגים? כמות לומדים? כל מה שאת חושבת שזה יכול היה להשליך על הכיתה.

אמילי: אצלי כמו שאמרתי לך קודם, הילדים תמיד ביום רביעי בבוקר היו שואלים אותי מה אתמול לא הייתה קהילה? כאילו הילדים כבר מחכים לזה שאני אבוא עם דברים מהקהילה. זה עניין אחד. הם תמיד **מחכים לזה שיבוא משהו חדש מהקהילה** ואנחנו מדברים על הקהילה. אני מספרת להם שאני משתתפת בקהילת מורים **ואני מרגישה שזה משרה עליהם ביטחון. שחוץ ממני יש לי עוד גב. יש לי עוד אנשים איתי. גם מהפיקוח וגם מהמורים האחרים בעיר שהם גם משתתפים בקהילה הזאת. אני חושבת שהילדים מרגישים מאוד בטחון מזה. יש לי תחושה כזאת שיש להם סוג של הקלה שזה לא רק אני והם בכיתה.**

דפנה: יש עוד משהו שקשור לשאלות וקשור לקהילות ולא חשבתי עליו שתרצי להגיד לי?

אמילי: היו לנו 2 מדריכות נהדרות. מסבירות פנים ואדיבות. זה חלק מהעניין, האדיבות **והתחושה הזאת ששמחים שאני מגיעה**. באמת זה **תחושה נורא טובה.** אני לא אומרת את זה רק בשם עצמי אלה **בשם כל האנשים בקהילה** החל בבן אדם הכי מאוס שם עד הבן אדם הכי מקסים שם. **סבר הפנים היפות והנעימות שווה לכולם** וזה באמת דבר מדהים אני לא חושבת שאני עצמי הייתי מסוגלת לעשות את זה. מי כמוך דפנה, יודעת את זה..

ראיון עם רוז - Interview with Rose

דפנה: אנחנו מדברים בכלליות, לא בהכרח על שנה זאת, על קהילות. אחר כך אתן לך זמן חופשי להגיד מה שאת רוצה על קהילות אך עכשיו אני נותנת לך כמה שאלות מכוונות.

שאלה 1- מה התפיסות של מורים לפיזיקה לגבי קהילה מקצועית לומדת? זאת אומרת, מה מורה שלפני שהוא הגיע לקהילה חושב על קהילה מקצועית לומדת ואחרי שהוא משתתף בקהילה, מה הוא חושב על הקונספט הזה שנקרא קהילה מקצועית לומדת?

רוז: אני אגיד לך מה אני חשבתי לפני שהגעתי לקהילה. זה היה לפני הרבה שנים, כשפתחו את נושא הקהילות, אני חייבת להגיד לך שהייתי מה זה סקפטית. מהבחינה הזאת של: עוד פעם השתלמות? עוד פעם להעביר את הזמן? לא מועיל וזה סתם מבזבז את הזמן. לא זוכרת בדיוק, האם את שכנעת אותי או שאורנה, לא זוכרת מי בדיוק שכנע אותי ואז אמרתי נלך, מה יכול להיות. ואז ברגע שנכנסתי, גם עדיין בשיעור הראשון, את יודעת כי אני אדם סקפטי מאוד מצדי, אז גם בפגישה הראשונה שהכרנו חשבתי לעצמי עוד פעם פגישה ועוד פעם להכיר. כאילו מה אני כמו ילדה קטנה? באתי בגישה אני חייבת להגיד של אנטי. אבל בגישה של מאה שמונים מעלות, מקצה לקצה אחרי כמה פגישות הבנתי שזה משהו אחר לגמרי. זאת אומרת שזאת לא השתלמות רגילה של לא לעשות וי וללכת. אני ניתרמתי בהמון מישורים. בהתחלה לא הכרתי את המורים הייתי די חדשה בעסק. אני כל חיי אני זאב בודד לא היו לי קולגות איתי בבית הספר, מורים לפיזיקה ואם היה, אז בואי נדלג על השלב הזה. לכן מצאתי מענה בהמון מישורים בקהילה. זה לא ישר בפגישה הראשונה, זה לאורך זמן וככל שעוברות השנים אתה יותר ויותר מעריך את מכרה הזהב אפילו היהלומים שיש לך ביד. כי זה גם הופך, אני חייבת להגיד, זה הופך **למפגש חברתי**. אני די לבד בבית הספר מבחינת קולגות, מורים לפיזיקה. אני לבד. וזה נורא קשה שאין את השיתוף הזה של הפעילויות. כמה אני יכולה כבר להמציא? אתה נשחק מהר מאוד. מבחינת זה שיש לי עם מי להתייעץ. הקהילות נתנו לי את הפתח את הצוהר להכיר אנשים שאפשר להתייעץ איתם **מבחינה מקצועית** או אם יש איזושהי שאלה שאני לא יודעת לפתור אז אני יכולה לבקש עזרה. אין בנאדם אחד שפניתי אליו והוא לא פתח לי את ליבו ודלתו. הוא ממש ופתר וענה. אם לקח לי שאלה מסוימת שחיברתי, עשר שעות ואני עדיין תקועה על הדבר הזה ואז בא מישהו מבחוץ ופתר לי את זה. אמר לי תשימי לב, לקנה מידה. בגלל שאני מחברת, אני חושבת קדימה ולא חושבת על הדברים הקטנים האלה, זה ממש ערך מוסף. דבר נוסף, בכלל כל **הרעיונות של לחדש לכיתה**. למשל פינת הצעצוע. היה מדליק. דרך אגב אני לוקחת את זה. יש לנו עכשיו בתיכון, המנהלת השנה איפשרה לעשות חדרים: חדרי לימוד. חדר מתמטיקה, חדר פיזיקה, חדר היסטוריה. אחד מהרציונל שלי לחלום , לבנות חדר, אני הולכת לעשות את אחת הפינות כפינת הצעצוע וזה לא בגללי, זה בזכות הקהילות. נשים בובה ענקית ונרשום עליה פינת הצעצוע. אחת

לכמה זמן פשוט נציב שם צעצוע. סתם דוגמה, אני יודעת, את מחזירה אותי כמה שנים אחורה כשלמדנו מגנטיות, הבאת את הסביבון המגנטי שמרחף באוויר. למשל דוגמה כדי ללמד כאם מושרה. אני אשים שם את הסביבון ואבקש מאחד התלמידים לנתח ממש את הצעצוע ואיך הוא עובד. והוא ירצה שם לאחרים.

דפנה: אז גם **למידת עמיתים?**

רוז: לגמרי. מהניסיון שלי, בהתחלה כשאתה לא מכיר אז אתה עושה בדיוק, ללא שינוי. כמו שאתה אופה עוגה בהתחלה לפי המתכון. לא זז,לא ימינה ולא שמאלה. פתאום לאחר שאתה מתנסה פעם פעמיים וצובר בטחון אתה לא מפחד לשדרג עם אגוזים, צימוקים, סוכריות, אותו דבר עם הפעילות. לקחתי מפינת הצעצוע שאנחנו היכרנו בקהילה פתאום להפוך את זה לקיר שלם לחוויה אחת גדולה, גם ללמד עמיתים, גם איך לדבר מול קהל וגם מבחינת סיעור מוחין של המורים אז זה נהדר **מבחינה מקצועית. גם מבחינה חברתית** כייף לפגוש ולהתרענן להגיע ולפגוש אנשים שאתה נהנה עם האנשים. אחלה קהילה זאת. אני יכולה להיות בקהילה אחרת ובוחרת להיות בקהילה אצלכם. למרות שיכולתי להיות בקהילה יותר קרוב לבית. אבא שלי גר לידכם אז אני עושה שתי מצוות במכה, גם מבקרת אותו וגם על הדרך משתתפת בקהילה. דבר נוסף, גם לא **רק חברתית , קבוצת תמיכה נקרא לזה.** גם איפשהו, לא הכל הולך חלק ויש ימים פחות נחמדים אתה בא לקהילה ופורש את זה ואתה רואה שאתה לא הדפוק היחיד. אתה לא יוצא דופן. לכולם יש הפס אנד דאונס. לכולם איפשהו כבר די ההוראה יצאה מכל הכיוונים. זה מפיח רוח חיים חדשה וזה הרבה גם הודות לכם. אם זה את ומיקי ואנדריי החמוד הזה שיש לו ידע ענק במעבדות. אין לקחת את זה ממנו. יש לו ידע ענק. זה ממש ממש באמת. ביחסי אנוש שהם לא פחות חשובים אם לא החשובים ביותר, שהאישיות שלכם ממגנטת אותנו לשם. חוץ מזה שמעבר למקצועיות והכל **אני זכיתי להכיר חברות,** לא פחות חשוב.

דפנה: פאן חברתי חשוב לא פחות. ברור!

רוז: כן. **זה הכל מהכל**, ממש. נותן מוטיבציה להמשיך.

דפנה: אני אפנה אותך לשאלה 2 אבל אני חושבת שעל חלק ממנה ענית אז תראי מה יש לך להרחיב.

<u>שאלה 2-</u> אלו פעילויות ואסטרטגיות מורים עושים בכיתות לאחר שרכשו אותם בקהילות? למשל אנחנו מראים בקהילה פינת הסרטון, פינת הצעצוע, אסטרטגיה לפתרון תרגילים, שאלות דיאגנוסטיות, מה מתוכם לקחת לכיתה?

רוז: וואו! הכי הרבה לקחתי את פינת הסרטון שזה מהמם ופינת הבדיחה שזה גדול. אני טיפוס שמשתעמם מהר אז גם בשיעורים כדי שאני לא אשתעמם, אני לא מתביישת להגיד שזה בשביל התלמידים אבל גם בשבילי, כל פינת הסרטונים מהנה אותי מאוד ואז שדרגתי את זה ואמרתי בואו נראה את הסרטון שהבאת חוקי ניוטון, חוק ראשון חוק שני. ראיתם את הסרטון, כעת שיעורי בית אתם הולכים לבנות סרטונים. כלומר קחו את זה אך אני מרימה את זה עוד צעד אחד קדימה. נושא המעבדות כל הפרקטיקה בעיקר איך לפתח את הדיון הפיזיקלי בכיתה, זה מאוד חשוב. או התפיסות שגויות וכל הדיון על זה עם המורים שאנחנו דנים עם עצמנו, זה תורם לנו ללמד את התלמידים איך לחשוב. זה הכי בולט בקהילות, התרומה הזאת איך ללמד נכון.

דפנה: שאלה נוספת שאני רוצה לשאול אותך, <u>שאלה 3-</u> מה התועלת בלהיות חבר בקהילת למידה בפיזיקה? מה את מרוויחה מזה בעצם?

רוז: אני מרוויחה המון. דרך אגב אני הייתי בעברי מורה למתמטיקה ואת נכנסת לחדר מורים ורואה כל מיני סוגים של מורים. לא יעזור כלום. מורים לפיזיקה זה אחרת. הם יותר יציבים, הם ליגה אחרת, ליגה. לכן אני מעריכה את כל התרומה הזאת של המורים, אחד לשני. אני אוהבת שאתם [המורים] מלמדים ולא שומרים את זה לעצמכם. אנחנו משתפים וחולקים אחד עם השני. אתה **תורם ונתרם** ומרגיש שכייף לך גם לתרום וגם שאתה מעביר הלאה. ללמוד על מנת להשפיע ולא להיות אגואיסט, **לחלוק ידע וזה גם ערכים שאתה מקנה לתלמידים**. כי אם למשל אני משתמשת בחומרים מהקהילה אני אומרת בכיתה, **חבר'ה זה מהקהילה, זה לא שלי.** נותנת את הקרדיט והכבוד למי שנתן לי. כי אלו ערכים שצריך ללמד את התלמידים, **ערכים של הכרת הטוב. זה לא ברור מאליו. אף אחד לא חייב לי כלום.** אז זה הכל מהכל.

דפנה: עכשיו אני לוקחת אותך לכיתה, זאת שאלה שבעצם שייכת לכיתה. <u>שאלה 4-</u> האם ההשתתפות שלך בקהילה כמורה, שיפרה לדעתך את למידת התלמידים בכיתה? כלומר האם זה נהייה להם יותר מעניין ? זה נהייה להם יותר רלוונטי? הם הצליחו להגיע להישגים יותר גבוהים? כמות התלמידים גדלה? שלא איבדנו תלמידים? כלומר אני לוקחת אותך מהקהילה לתוך הכיתה. איך הכיתה הושפעה מכך שאת בקהילה?

רוז: אין ספק, חד משמעית שזה משפיע על הכיתה. **כשאני בקהילה אני לובשת את כובע התלמיד.** אני תלמיד לכל דבר. **אתם לא מוותרים לנו בהתנסות בפעילות**. גם אם אין לנו כוח לפעמים. **אני מתנסה ואחר כך אנחנו מעבירים פידבק** מה יותר טוב ומה פחות טוב. זה גם חוסך לי עבודה בבית. אם אני רוצה לבחור פעילות מסוימת אני יודעת מה יותר מדבר אלי ומה פחות מדבר אלי. אני לא לוקחת את כל הפעילויות, רק מה שמדבר אלי ושאני

חושבת שיתאים לתלמידים שלי. יכול להיות שבשנה מסוימת פעילות זו תתאים לשנה זו ופעילות אחרת תתאים לשנה הבאה ולא בהכרח לאותה כיתה. **יש לי ארסנל של פעילויות**. מטבע הדברים **אני גם לומדת להיות מורה יותר טובה, אז אם אני מורה יותר טובה אז מגיעים לי תלמידים יותר טובים**. **אני משפרת אותם, אני משדרגת אותם**. לראייה כאשר התחלתי מגמת פיזיקה בתיכון הייתי עם 14 ילד ועכשיו לאחר 12 שנה אנחנו במגמה עם 80 תלמידים. זה לא ברור מאליו. גם אם בעבר היו יותר בנים, היום זה חצי חצי. חצי בנות וחצי בנים. אז גם על כל העניין של מגדר, בנים בנות שדיברנו בקהילה, לקחתי כטיפים, איך להוביל את הבנות, איך להגדיל להן את הביטחון. אחד הדברים הטובים שלמדתי בקהילה הוא איך לגרום לכיתה להיות באווירה לימודית אך לא תחרותית. כלומר תחרותית בריאה לא תחרותית של לזלזל אחד בשני ושתלמיד יפחד לענות שמא הוא יטעה והכיתה תצחק. זה ממש חשוב מבחינתי.

אני גם מדביקה בהתלהבות שלי את התלמידים על ידי סרטונים שאני מביאה מהקהילה או פעילויות שאני מביאה מהקהילה לכיתה ואז **התלמידים נדבקים בהתלהבות ולא נשארים בנישה שאני מלמדת. פתאום הולכים וחוקרים והרבה פעמים עושים לי שעורי בית**. אני לא מתביישת להגיד שאני לא יודעת ואז כולנו חוזרים הביתה ולומדים. סתם דוגמה, בתחילת דרכי בקהילות כשלימדתי השראה, לא ידעתי בדיוק איך הרכבת המרחפת ביפן פועלת ובזכות הסביבון שראינו בפינת הצעצוע, זאת הסיבה שאני זוכרת אותו טוב, אז קודם כל חקרנו אותו על ידי משחק אחר כך בדקנו ואז תלמיד שאל אותי איך הרכבת עובדת ואז אמרתי נראה לי ככה וככה.. אבל בואו נחקור והתחלנו לחקור וזה פותח את כל הגלגלים במוח ומפתח את הילד איך ללמוד ואיך לחשוב ולא רק "להקיא" את החומר. חוץ מזה אחר כך הם חוזרים אלי, אחרי כמה שנים ואומרים שהם לא שכחו אותי אחרי כל כך הרבה שנים, ואומרים כמה היה לי כייף ללמוד אתך וגם בצבא וגם בפקולטה להנדסה אנחנו כוכבים. אז זה מבחינתי עשיתי את שלי. אנחנו המורים רק שליחים ובזכותכם אני מורה טובה יותר.

דפנה: האם יש משהו כללי שלא חשבתי עליו בשאלות על הקהילה?

רוז: אולי כמו שיש קהילות של מורים, אולי שווה לעשות קהילות של עמיתים, קבוצת תלמידים, מדריכים צעירים, קהילת תלמידים מכיתות יא שילמדו את כיתות יוד או את החטיבה. זה לא שאני אוציא את זה לפועל אבל זה רעיון, שווה לחשוב. תודה לך ולעוסקים במלאכה על העבודה המבורכת הזאת. יישר כוח גדול. תבורכו.

ראיון עם קרינה - Interview with Karina

דפנה: אנחנו לא מדברים על השנה האחרונה שלא נפגשנו. אנחנו דווקא מדברים על השנים בקהילה האמיתית שהיינו נפגשים ושלשמה פנינו מועדות בשנה הבאה. אז אני מכוונת אותך כדי שתדעי מה לענות לי ואנחנו מדברים על ארבע שאלות. שאלה 1 - מה התפיסות של מורים לפיזיקה לגבי קהילות למידה מקצועיות? כלומר מה את חושבת, מה ידעת לפני שבאת לקהילה? מה חשבת אחרי שבאת לקהילה? מה חשבת על הקונספט הזה שנקרא קהילה מקצועית לומדת?

קרינה: אני חושבת שזה דבר מאוד מאוד חשוב. לחדשים כי הם חדשים ולוותיקים כי הם ותיקים. כלומר **זה עונה על הצרכים של כולם**. חדשים זה נותן להם את היכולת להיפגש עם מורים ותיקים, לפגוש צורות לימוד שונות ונותן המון טיפים לדרך. למורים ותיקים זה מעולה, כי זה **מרענן אותנו** וזה חשוב, לראות את הטריקים החדשים, לשים לב לנקודות מבט חדשות. זה **שומר עלינו ערניים.**

דפנה: שאלה 2 - אילו פעילויות ואסטרטגיות מורים מפעילים בכיתות לאחר שרכשו אותם בקהילות? למשל ראית סרטונים, ראית פינת הצעצוע, ראית פינת התמונה, למדת אסטרטגיה של שאלונים דיאגנוסטיים. מה מכל אלה את באמת חושבת שמורים לוקחים לכיתות?

קרינה: שאלונים דיאגנוסטיים, באמת נוצר בהם שימוש ואני עושה בהם שימוש מאוד מאוד גדול. נחשפתי אליהם ומצאתי את הדרך להשתמש בהם לצרכים שלי. **פינת הצעצוע, מגניבה ביותר. איך פיזיקה משתלב בחיי היום יום. כל החיים שלהם התלמידים שואלים אותי בשביל מה אני צריך את זה? אז הנה התשובה לשאלה בשביל מה אני צריך את זה?** בפשטות, ברכות, לפעמים גם אם אני לא מוצאת את הצעצוע עצמו אז אני מקרינה להם את מה שהסרטתי בקהילה. גם הסרטונים שימושיים אך זה מאוד תלוי באיזה תקופה זה היה מוקרן. לפעמים זה התלבש בול על הנושא שבדיוק כעת לומדים בכיתה ואז השימוש היה מידי ולפעמים זה מחכה שנה. אבל יש שימוש בהחלט.

דפנה: שאלה 3 - מה התועלת לדעתך בלהיות חבר בקהילת פיזיקה לומדת?

קרינה: אז קודם כל זה מאוד מאוד עוזר בפאן הרגשי, במיוחד בתקופת הקורונה ראינו את זה. **אנחנו לא רק אחד עם עצמו. אנחנו לא רק עם הצוות שלנו בבית ספר.** אנחנו פתאום נחשפים וחשופים **להרבה יותר אנשים שטכנית הם כמונו**. אז בפאן הרגשי זה מאוד מאוד עוזר ותומך. במיוחד ראינו את זה בקורונה שבהתחלה כולנו היינו בהיסטריה טוטאלית ואז מפגש אחד של קהילה וכולנו נרגענו. אז במיוחד בפאן הזה.

דפנה: שאלה 4 - האם השתתפות בקהילה שיפרה לדעתך את הלמידה של התלמידים בכיתה? מהבחינה הזאת שאת כמורה הפכת להיות יותר מעניינת? הפכת להיות יותר רלוונטית? אולי אפילו משהו בהישגים או בכמות התלמידים?

קרינה: ברור.

דפנה: אני לוקחת לך עכשיו את השאלה לתוך הכיתה.

קרינה: אז כן. התלמידים בהחלט הרוויחו. כי **ככל שמורה נחשף ליותר תכנים, ככה הוא מעביר ביותר עניין את התכנים והרווח הוא תמיד של התלמיד**. **גם מורה וותיק שיכול לדעת את החומר פרפקט, מספיק שפתאום יראו לו איזה ניצוץ קטן חדש שידליק אותו. אם זה מדליק אותו, זה גם ידליק את התלמידים.**

דפנה: אוקיי. תודה. אין יותר שאלות, אלא אם את רוצה משהו ספציפי שאת רוצה להגיד על הקהילה שאני לא חשבתי עליו.

קרינה: אני רוצה להגיד שהיתרון הכי גדול עבורי בקהילות זה המנחים שהיו לי לאורך כל הדרך. התחלנו את הקהילות עם אנדריי ודפנה. השנה אנדריי פרס וזכינו במיקי. וכשיש צוות מוביל כמוהם, הכל נעשה בכיף, הכל נעשה בטוב טעם, כל הרעיונות עוברים באווירה נעימה. **אי אפשר לקרוא לזה קהילה, יותר קל לקרוא לזה בית. זה משהו שאתה מצפה לו משנה לשנה.** פשוט וקל. אז תודה למנחים והלוואי שכל הקהילות יזכו לכאלה מנחים.

Appendix D: Protocol Conference of Communities 2020, 2021

This appendix is a partial translation of the protocols transcribed in the years 2017-2021.

Quotations were taken mainly from the first part of the document, hence only this part was translated.

This is a transcript of the farewell call recording from the beloved community leader, Andrei.

This is also a summary of a year of activity of the Paris community.

The translation is authentic without any linguistic correction or processing.

The highlighted paragraphs are the ones from which quotes for the "Findings Chapter" were taken.

Transcript of the PLC'S Conference 8/6/2020- Community Zoom meeting and farewell to Andrei:

Daphne: The meeting will begin without Mickey and without Andrei unfortunately. Please allow me to take a picture of our group

Karina: It's really bad to start without Andrei

Sabrina: What happened to Andrei?

Daphne: Andrei had to attend but did not make it. He works today and it turned out that's precisely when we wanted to say goodbye to him.

Last night, for 40 minutes, I made him a congratulatory letter from us and it turns out that he is unable to participate. So neither Mickey is not participating nor Andrei is not participating and we are in a small lineup, I'm sorry.

Anton: But it's recorded. He will see it any way.

Daphne: I recorded it for him. So we can say a few words to him. So Karina will start, because Karina bought him a present in our name. You know that Andrei will not continue with us next year, unfortunately. It also means that we have to look for another home for ourselves. That we do not yet know where we will be hosted, but we will no longer be in Paris. Sabrina said she would check for us in her high school. Sabrina, do you have an answer?

Sabrina: I asked the manager and he said we'll talk later and that's it. talk to you later.

Daphne: We want the London area because we want the teachers of Rome to be close too. In the village where Mickey works, it's an option, but it's far away. In London, it's a good place in the middle. There is a large concentration of teachers from London and a large concentration of teachers from Rome. So we did not want more than half an hour drive and I was afraid that if done in Rome then London teachers would not come.

Sabrina: You do not trust us to come?

Daphne: We respect and pay attention also to young Roman teachers. They can travel. I'm not in the right category, but most of the teachers are young. Here you see Anton he has some 20 years for me, so he can go.

Karina: Also Anton, Stanislav, Philip, Oliver.

Anton: I'm even coming from Cairo.

Sabrina: I can also travel. Nothing will happen to me.

Anton: We'll move to Zoom

Karina: No, no. Do not go to zoom because the main thing is the meeting and the food. Do not switch to any zoom. Let me see some people can no longer. All day taking off glasses, putting on glasses, because of the distances in sight.

Anton: And what about Andrei's laboratory assistant? [The laboratory assistant usually prepares the dining table]

Daphne: That's it. Andrei's laboratory assistant is over with Andrei. We will say goodbye to her. There will be no more soup, that's it. We'll have to take care of ourselves. Looks like 'maybe we'll order food from somewhere.

Karina: Yes, it is also possible. Well, I want to show what we bought as a gift to Andrei. I will also send pictures to the group. This is an example of what you will see here. Because it's packed and I'll send a picture with a dedication. Write on the pen "It's time to say goodbye" or something like that ... "It's time to say thank you"

Mickey has just joined Daphne: Oh, Mickey has finally joined.

Karina: She joined just in time. I also bought one like this [shows a packaged package] immediately got it from them. It is a table stand with a figure of Albert Einstein and we added a caption there and wrote "something small for a big person, in appreciation of the Paris community"

Sabrina: Very beautiful

Karina: I'm sending this now to the WhatsApp group

Although he [Andrei] will see it.

Daphne: Even so, he knows we bought him a present.

Karina: I have money left over for next year. So Daphne at the first meeting, I bring the food.

Daphne: All right. Although we do not yet know where the first meeting will be. In case of emergency, if we do not have a place to meet, we set at Aroma [a famous cafe] on the way to Paris there is a great Aroma.

Sabrina: By the way Daphne I asked Mickey how much of a principle it would actually be Tuesday because our school on Sundays and Wednesdays has had many evening activities for many years. These days a school is open in the evening and opening it on another day is problematic.

Daphne: Then we may have to replace the day. Have you all heard?

Mickey: Wednesday is better because Sunday is a hard day and it's best not to make it a long day.

Daphne: Wednesday is pretty close to Tuesday and just needs to change habits.

Sabrina: So I'll ask now about a specific day and maybe it will help me advance things.

Daphne: Where's your school? Located north of London or south of London?

Sabrina: It's southern but the travel time is the same.

Daphne: So it's about the same distance as Paris to people coming from Rome?

Sabrina: Almost. It's an insignificant addition, it's in a different direction.

Daphne: I'm taking the opportunity here to tell you that I'm recording this to give Andrei and say thank you very much on behalf of all of us. We spent seven years together and time flies like water. Every year passes and now it is the tenth year of the communities. I feel like I'm getting older along with it and I cannot believe how it went so fast. And this year a lot of young people joined us, Stanislav, Ben, lowered our average age which was very nice and you also contributed new ideas. Stanislav especially I hope you stay with us wherever we go?

Stanislav: I stay with you all the time.

Daphne: Son I do not turn to him because I do not know if he is with us. Ben are you here?

Ben: Yeah I'm just quiet today.

Daphne: So I tell you too, I hope you stay with us. You are a young teacher with us. Lowers us really significantly the average.

Ben: I really have no choice next year

Daphne: That sentence is really not nice

Mickey: Daphne might post a link on WhatsApp

Daphne: I sent a link. Everyone knows it's a summing up session in Zoom

Mickey: But it was so fast. I'm sure as I barely had time to drink water. So write that we are waiting for everyone and the truth is that we have to wait a bit for a few minutes because it was really fast

Daphne: I'll write again

Mickey: Call Andrei too

Daphne: He's not responding anymore. I sent him, but he probably cannot reach. it's not important. So I take this opportunity to tell you that I had a lot of fun with you this year of course. We all learn from each other here, it's not that I teach you, everyone here learns from everyone. We had a year here, actually half a year, that everyone brought things here and not yet to all of us. I think we all came out profitable. We learned things. Sabrina Thank you so much especially for your show, it was fun, it was special.

Mickey: It really was special

Daphne: We all learned to deal with zoom. Do you remember that in the beginning when there was still initial hysteria, how many ideas were shared here? It was a kind of support group that I do not think every teacher had the option to ask questions and how do you do? And how do you convey? And I with a board and I with a camera .. There was a kind of mutual help like in the real community. So I think we all made it through this period even though personally it's not fun of course to be zoomed in and not in person. I at least think so. Well I see Emily connecting too. I assume that if the advanced training returns, then next year we will return to regular training. I already know that the summer courses at the Weizmann Institute are held as a usher, but with a limited number of people. Only up to 15 people are allowed because of the space in the room. I guess we will have no significant change and we will be able to [meet] as always

Stanislav: When does registration open to communities?

Daphne: Probably in September and even after they already knew what was happening. But the training itself does not start before October, in any case. End of October, like an academic year.

Stanislav: It has been said that there will be summer courses and they have not yet published anything about it.

Daphne: In my opinion, no summer courses have been opened yet. I know there are teacher training courses at the beginning of their journey, but I do not know how to answer that.

Nina: As for advanced training, a stable training center for digital tools, it has opened.

Daphne: Continuing education in this stable home in boarding school conditions. That's very nice.

Jack: Daphne, can you mention what about the concluding assignment? Where is it needed and what is it?

Daphne: A concluding assignment, it's very similar to what we do all year only this year we talk more about distance learning. Send me of course via email.

Mickey: Daphne will send the assignment again the next time they know exactly what they are asking for.

Daphne: I'll send it by email to make it safer for everyone but some teachers have already sent it to me. Emily sent me. Adrian sent it to me. Some have been sent. Emily loves to get rid of chicks, not dragging. Mickey, do you want to say something?

Mickey: Can I make a short game? Are we few people or are you tired?

Joe: It's better for everyone to say something in conclusion

Mickey: Okay, so everyone here will say something to summarize the community. What did he learn from the community? What was special about him this year? Or whatever you want

Daphne: And a few words about Andrei, because I'm sending him the recording. Joe you're a beginner, you're the initiator.

Joe: Yes. First I'll start with things for Andrei. I still consider myself a new teacher even though this is my fourth year. But I still learn new things every day. And I'm still trying to reinvent myself. And the character of Andrei was for me very dominant in the whole design of: What kind of teacher do I want to be? really! I mention him at every opportunity. In every interview they do for me. In every conversation they talk to me about what teaching is in my eyes and where I want to take physics. So his character is, in fact, yours, because I'm telling you Andrei, you hear that. Your character was an inspiring character for me and it was very important to me to tell you that. For this community, I also want to compare. And I tell you, I hang out with my colleagues at school in various fields of knowledge and English history and so on. I think and I say this carefully, there are no things of the kind we have here in other professions. In the aspect of sharing, in the aspect of regularity of meetings, sharing of knowledge and materials, which in my opinion does not exist in such an ingrained way as there is here. These meetings are for me a really extraordinary privilege. And we have to just keep at it, keep developing. There are a lot of ideas for next year, which I would of course like to share with you at the beginning of the year whether it works for me or not. That's it, just keep going.

Daphne: There's no such thing as Joe. Andrei will also be delighted when we hand over the recording to him. Zvika you joined us and Andrei could not join so we will pass the recording to him we recorded this call so we can later send him in addition to the gifts we bought him and we will reach him. Karina and I will personally go to his house to get it for him. Do you want to tell us a few words Zvika? Because I know you are a guest in all the communities.

Zvika: I am now with three communities in parallel. I do not have enough computers. So I wander from community to community so that at least I can be at all the parties. I want to congratulate you. It was an amazing conference thanks to you mostly. People who persevere, come, work, are within the communities I congratulate you that we will win next year, the year of the decade, and I also very much hope that we will succeed. You do not remember how the year began. I did not want to mention. She started late and more late and more late.

Daphne: I think we started in December.

Zvika: We forgot what the beginning of the year looked like. There is a concept called: "Last troubles forget firsts" The last troubles are really troubles so there is really nothing to talk about firsts. I wish us that we would overcome all difficulties. That we will continue the capacity for community work. I did not just talk about participation, which is the basis. I did not just talk about sharing and materials and collaboration. The goal is a sense of partnership, a sense of community. I move on to the next community. I'll stay a bit in the background to hear what you're talking about, because first someone there spoke very nicely. So I would love to keep hearing.

Daphne: It was Joe.

Emily: Well Daphne I want to talk now.

Daphne: Happily, Emily

Emily: I want to tell you and Andrei and I always write this in the summary work as well, that you are amazing instructors. Joining you this year, also Mickey, who was no less amazing. But the cooperation between you and this fun of what you're doing to us called [Paris] is really, really, really, not obvious. I want to tell Andrei that he will succeed further down his path. But I'm terribly sad he's leaving us. Really, I'm sad because you had a really great collaboration and it's a shame he left us. But that's how it's all the hard partings and that too it will be a hard parting from him. I hope we will be good next year without him too. If not, we will invite him to be a member of the community.

Daphne: Let him come, eat, do us a little demonstration and go his own way.

Emily: A little demonstration and going into his affairs, exactly, I learned to love him. With the kind of toughness and the kind of seriousness and the kind of humor. He's a really amazing man. We love him very much. Thank you so much, all of you, truly being an amazing community. Unfortunately, I just have to leave, so excuse me.

Karina: Wait a second, just a second. I want to say first of all thank you to all the friends because it was a meeting I enjoyed and I do not call it at all in my study diary it is called a friends meeting. So really it's connections on another level. It has made our community and our teachers and our partnership on a whole different level. I have no problem calling any of you, asking for advice and asking do you have a test to give me? What do you offer there? What are you offering here? And the level of our connections has really turned from a community of teachers into friends. That's one thing. Now bye Emily. Have fun.

Now I want to thank those who created this community. This is Mickey, who joined this year and has already felt the new and young and energetic blowing wind. To Daphne and Andrei that from the beginning we are following you. Wherever you go, wherever you say the community will be, there we will come. Passing all the training is fun, relaxed and it's just a pleasure. And always learning something new no matter how many years I am in the system. 25 years God help us. Every time you learn something else, every time you see something else. I went into his classes, sat like a good girl and a good student and watched how he delivered. And there is no better guide. When Daphne told me that a course was being opened with Andrei, I said to her: My Andrei? Because he's mine forever. She told me yes and I told her I was coming, no matter where it was, and it really proved itself. The man does not get tired, no matter how many years he is in teaching, and he invents, and the joy of his teaching is something that I wish we all clung to and would not end up in life. So dear Andrei. I wish you to choose the routes that are good for you, the one that you enjoy and will only go where it is good and that you enjoy. We will miss you very much. Emily's idea of bringing you in as a consultant once a month is great, and I promise the refreshments this time will be on us. We will miss you very very much and feel free to visit us whenever you want. Thank you very, very, very much, for all the years.

Daphne: Thank you Karina. Thanks. well said. Friends, does anyone else want to say something?

Jack: I want to. First of all, I want to say thank you so much for creating such a community. Truly this is not an in-service training, it is fun to come, really, for something that I wait for, I enjoy being in it, and the atmosphere between the teachers truly is something amazing that there isn't in other places. Really a very very special community. I also want to tell Andrei thank you for all the knowledge and the patience over the years and all that he taught me. I feel that I really learned and he was really a teacher for life and how to be a teacher of physics. The most important thing that I learned from him I think, **when I began to be a teacher I thought that the teacher does all the lesson plans and that's it. we are done, you can this way teach all the time**, and the most important thing that I learned from him is that you need all the time to renew and all the time to invent new things and all the time to improve. This definitely I obtained from the community and especially from Andrei. Thank you very much, everyone and good luck to Andrei

Daphne: Has been a teacher for 40 years and is constantly upgrading himself ah .. that's probably how it should be. Only in this way will we not lose the shine in the eyes.

Mickey: Exactly I thought about it too and I want to say a few words to Andrei. First of all I'm adored him since I was a rookie. I'm excited about him being constantly redesigned. He's always interesting. I learned from him the enthusiasm that I need to pass on the enthusiasm to my students who will also adore that enthusiasm. So I'm constantly looking for her. And when I was not with you, I was in research physics I can say that you were really missing me in the section of the community. In the section of coming as Karina said it's not advanced training it's friends. Be a partner of teachers. You are usually a lone teacher or two max one more in school and that was very much lacking to me. Ever since I came back it's been such fun. It was a pleasure for me. I really felt like I was renewing the teaching and I was once again coming enthusiastically to class. And that was a very significant point. So let's keep hoping next year that Andrei will come visit us and give us that enthusiasm and the spark again.

Stanislav: I just want to say one last word that will be short and to the point. first of all thank you very much. I'm new to the bunch and I thank you for the reception and I feel pleasant and fun with you and it's not trivial. Thank you so much Daphne and Mickey thank you so much to Andrei for all this amazing organization, Karina's food and everything you do during the year. See it. This is not negligible. As for Andrei when I look at Andrei I see Leonardo da Vinci is the truth. The only connection between them is that he is also a scientist and he is also a painter. I remember the first question I asked Andrei as for a cyclist dropping his body. So the first thing Andrei did, he took a piece of paper and began to draw the cyclist and the angle. And to this day by the way I have this drawing and I keep it with me and I show it to everyone and say it's a physics teacher that's how a physics teacher should be. He drew it so beautifully the rider that he shifted and he explained beautifully I kept this picture and it's in Andrei's eyes. So I think if one day I get to be half from Andrei then I will be a perfect teacher. So first of all thank you very much Andrei for everything you have done for us. And we hope to see you later as well. Thank you.

Sabrina: I think I know Andrei better than any of you in terms of years. He was also my neighbor at the time. So Andrei although we are not neighbors, we always met in training and I was very happy. And everything that all people say I agree with all the words and want to add another good word. When I feel like I'm already tired and I no longer have anything to create new I look at you and I'm amazed at your never ending ideas never ending forces. Just jealousy but jealousy in the good sense. so good luck.

Mickey: You Sabrina is not missing either

Sabrina: No. But it's not like Andrei. He enjoys not only physics he also enjoys math.

Harry: I want to say congratulations as well. The truth is that it's a little hard for me to talk when Andrei is not here or talking to you actually when you just hear the recording. I think Andrei you're a noble man. A special person. A man with a wide heart, a big heart. It's true that you understand physics and math and a lot of things, but I think your magnification is not in that. Your magnification is that you transmit everything calmly and calmly. Not in the kind of which I know these in the kind of joy. You live things. You really live them. And every time I hear and see and learn things from you I enjoy and am happy. The truth is it

was a great privilege that we had in those years to be with you and succeed and move on. I wish we could take some of the things we saw in you and apply them later in our professional work, in personal life. This is something fantastic. So it's true that all the members here are actually the ones who make up the community here but there is no doubt that you together of course with the loyal partnership Daphne and Mickey are building the community. But there is no doubt that you are a team leader, significant and serious and with the help of the name we will all continue next year and have lots of success. Thanks.

תמלול כנס קהילות 8/6/2020 - מפגש קהילה בזום ופרידה מאנדרי

מפגש סיום כנס קהילות 8.6.2020 אנדרי נעדר מהמפגש ולכן הם נפרדו ממנו בזום

דפנה: המפגש גם בלי מיקי וגם בלי אנדרי לצערי הרב. תנו לי לצלם אתכם.

קארינה: הכי גרוע בלי אנדרי

סברינה: מה קרה לאנדרי?

דפנה: אנדרי היה צריך להשתתף אבל לא הספיק להגיע. הוא עובד היום וזה יצא שדווקא כשרציתי להיפרד ממנו.

אתמול בערב, 40 דקות, הכנתי לו מכתב ברכה מאתנו ובסוף הוא איננו. אז גם מיקי איננה וגם אנדרי איננו ואנחנו בהרכב מצומצם, צר לי.

אנטון: אבל זה מוקלט. הוא יראה את זה גם ככה.

דפנה: אני הקלטתי את זה בשבילו. כדי שנוכל להגיד לו כמה מילים. אז קרינה תתחיל, כי קרינה קנתה לו מתנה בשמנו. אתם יודעים שאנדרי לא ממשיך אתנו בשנה הבאה, לצערנו הרב. זה אומר גם שאנחנו צריכים לחפש לעצמנו בית אחר. שאנחנו לא יודעים עדיין איפה נתארח, אבל לא נהיה יותר בפריז. סברינה אמרה שהיא תבדוק עבורנו בתיכון שלה. סברינה, יש לך תשובה?

סברינה: אני שאלתי את המנהל והוא אמר נדבר אחר כך ובזה זה נגמר. נדבר אחר כך.

דפנה: אנחנו רוצים באזור לונדון כי אנחנו רוצים שגם למורי רומא יהיה קרוב. בכפר איפה שמיקי עובדת, זה אופציה, אבל זה רחוק. בלונדון, זה מקום טוב באמצע. יש ריכוז גדול של מורים מלונדון וריכוז גדול של מורים מרומא. אז לא רצינו יותר מחצי שעה נסיעה ופחדתי שאם נעשה ברומא אז מורי לונדון לא יבואו.

סברינה: את לא סומכת עלינו שנגיע?

דפנה: שימי לב אנחנו מכבדים ותשימי לב גם שמורי רומא צעירים. הם יכולים לנסוע. אני לא בקטגוריה הנכונה, אבל רוב המורים צעירים. הנה תראי את אנטון יש לו איזה 20 שנה פור עלי, אז הוא יכול לנסוע.

קרינה: גם אנטון, סטניסלב, פיליפ, אוליבר.

אנטון: אני מגיע מקהיר אפילו.

סברינה: אני יכולה גם לנסוע. לא יקרה לי כלום.

אנטון: נעבור לזום

קרינה: **לא, לא. לא עוברים ל zoom כי העיקר זה המפגש והאוכל. לא עוברים לשום זום**. תן לי לראות קצת אנשים לא יכולה יותר. כל היום מורידה משקפיים, מעלה משקפיים, בגלל המרחקים בראייה.

אנטון: ומה אם הלבורנטית של אנדרי? [כזכור הלבורנטית מכינה את שולחן האוכל]

דפנה: זהו. הלבורנטית של אנדרי זה נגמר יחד עם אנדרי. ניפרד ממנה. לא יהיה יותר מרק, זהו. אנחנו נצטרך לדאוג לעצמנו. נראה אולי נעשה הזמנה מאיזה מקום.

קרינה: כן זה גם אפשרי. טוב, אני רוצה להראות את מה שקנינו מתנה לאנדרי. אני אשלח גם תמונות לקבוצה. זה דוגמה מה שאתם תראו פה. כי זה ארוז ואני אשלח תמונה עם הקדשה. רשום על העט "זה העת להיפרד" או משהו כזה.. "זה העת לומר תודה"

מיקי הצטרפה ברגע זה למפגש דפנה: הו, סוף סוף מיקי הצטרפה.

קרינה: הצטרפה בדיוק בזמן. קניתי גם כזה רואים [מראה חבילה ארוזה] תכף אצלם את זה. זה מעמד לשולחן עם דמות של אלברט איינשטיין והוספנו שם כיתוב ורשמנו "משהו קטן לאדם גדול, בהערכה קהילת פריז"

סברינה: יפה מאוד

קרינה: אני שולחת את זה עכשיו לקבוצה למרות שהוא [אנדרי] יראה את זה.

דפנה: גם ככה הוא יודע שקנינו לו מתנה.

קרינה: נשאר כסף שאני מעבירה לשנה הבאה. אז דפנה בפגישה הראשונה, אני מביאה את האוכל.

דפנה: בסדר גמור. למרות שאנחנו לא יודעים עדיין איפה תהיה הפגישה הראשונה. במקרה חירום, אם לא יהיה לנו איפה להיפגש, אנחנו קובעים בארומה [בית קפה מפורסם] בדרך לפריז יש אחלה ארומה.

סברינה: דרך אגב דפנה אני שאלתי את מיקי כמה עקרוני שזה יהיה דווקא יום שלישי כי בבית ספרינו בימי ראשון ובימי רביעי יש כבר הרבה שנים פעילות של מופת ערב. בימים אלה בית ספר פתוח בערב ולפתוח אותו ביום נוסף זה בעייתי.

דפנה: אז יכול להיות שנצטרך להחליף את היום. שמעתם כולכם?

מיקי: עדיף יום רביעי כי יום ראשון זה יום קשה ועדיף לא לעשות אותו יום ארוך.

דפנה: רביעי זה די קרוב לשלישי רק צריך לשנות הרגלים.

סברינה: אז אני אשאל עכשיו לגבי יום ספציפי ואולי זה יעזור לי לקדם את הדברים.

דפנה: איפה בית הספר שלך? במיקום צפוני בלונדון או דרומי בלונדון?

סברינה: הוא דרומי אבל זמן הנסיעה הוא אותו דבר.

דפנה: אז זה בערך אותו מרחק כמו פריז לאנשים שבאים מרומא?

סברינה: כמעט. זה תוספת לא משמעותית, זה בכיוון אחר.

דפנה: אני מנצלת את ההזדמנות פה להגיד לכם שאני מקליטה את זה כדי לתת לאנדרי ולהגיד לאנדרי תודה רבה בשם כולנו. עברנו ביחד שבע שנים והזמן עף כמו מים. כל שנה עוברת ועכשיו זאת השנה העשירית של הקהילות. אני מרגישה שאני מזדקנת ביחד עם זה ואני לא מאמינה איך זה עבר כל כך מהר. והשנה חברו לנו הרבה צעירים, סטניסלב, בן, הורידו לנו את ממוצע הגיל שזה היה נחמד מאוד וגם תרמתם רעיונות חדשים. סטניסלב במיוחד אני מקווה שאתה נשאר אתנו באשר אנו הולכים?

סטניסלב: אני נשאר אתכם כל הזמן.

דפנה: בן אני לא פונה אליו כי אני לא יודעת אם הוא אתנו. בן אתה פה?

בן: כן פשוט אני על שקט היום.

דפנה: אז גם לך אני אומרת, אני מקווה שתישאר אתנו. אתה צעיר המורים אצלנו. מוריד לנו ממש משמעותית את הממוצע.

בן: אין לי ממש ברירה בשנה הבאה

דפנה: זה ממש לא נחמד המשפט הזה

מיקי: דפנה אולי תשלחי בוואטסאפ קישור

דפנה: שלחתי קישור. כולם יודעים שזה מפגש מסכם בזום

מיקי: אבל זה היה כל כך מהיר. אני בטוחה שכמו שאני בקושי הספקתי לשתות מים. אז תכתבי שאנחנו מחכים לכולם והאמת שצריך להמתין טיפה כמה דקות כי זה באמת היה מהר

דפנה: אני אכתוב עוד פעם

מיקי: תתקשרי גם לאנדרי

דפנה: הוא לא מגיב יותר. שלחתי לו ,אך הוא כנראה לא מצליח להגיע. לא חשוב. אז אני מנצלת את ההזדמנות להגיד לכם שהיה לי כמובן כיף מאוד אתכם השנה. **כולנו פה לומדים אחד מהשני, זה לא שאני מלמדת אתכם, כולם פה לומדים מכולם**. היה לנו פה שנה, בעצם חצי שנה, שכל אחד הביא פה דברים וטרם לכולנו. אני חושבת שכולנו יצאנו נשכרים. למדנו דברים. סברינה תודה רבה במיוחד על ההצגה שלך, היה מהנה, היה מיוחד.

מיקי: באמת היה מיוחד

דפנה: למדנו כולנו להתנהל מול זום. אתם זוכרים שבהתחלה כשעוד הייתה היסטריה התחלתית, כמה שיתפנו פה רעיונות והכל? **זה היה סוג של קבוצת תמיכה שאני לא חושבת שלכל מורה היה את האופציה לשאול שאלות ואיך אתה עושה? ואיך אתה מעביר? ואני בלוח ואני מצלמה.. היה סוג של עזרה הדדית כמו בקהילה ממש.** אז אני חושבת שכולנו צלחנו את התקופה הזאת למרות שבאופן אישי זה לא כיף כמובן להיות בזום ולא בפגישה אישית. אני לפחות חושבת ככה. יופי אני רואה שגם אמילי מתחברת. אני מניחה שאם ההשתלמויות חוזרות, אז בשנה הבאה אנחנו חוזרים להשתלמות רגילה. אני כבר יודעת שהיא השתלמויות הקיץ במכון ויצמן מתקיימות כסדרן אבל עם הגבלת אנשים. מותר רק עד 15 איש בגלל המקום בחדר. אני מניחה שאצלנו לא יהיה שום שינוי משמעותי ונוכל להיות [להיפגש]כמו תמיד

סטניסלב: מתי נפתחת ההרשמה לקהילות?

דפנה: בטח בספטמבר וגם אחרי שידעו כבר מה קורה. אבל ההשתלמות עצמה לא מתחילה לפני אוקטובר, בכל מקרה. סוף אוקטובר, כמו שנת לימודים אקדמית.

סטניסלב: נאמר שיהיו השתלמויות קיץ ולא פרסמו עדיין שום דבר על זה.

דפנה: לדעתי לא נפתחו עדיין שום השתלמויות קיץ. אני יודעת שיש השתלמויות למורים בתחילת דרכם, אבל לא יודעת לענות על זה.

נינה: לגבי השתלמויות, בית יציב השתלמות לכלים דיגיטליים, זה נפתח.

דפנה: השתלמויות בית יציב זה בתנאי פנימייה. זה מאוד נחמד.

ז'ק: דפנה, את יכולה להזכיר מה עם העבודה המסכמת? איפה צריך ומה זה ?

דפנה: עבודה מסכמת, זה מאוד דומה למה שאנחנו עושים כל השנה רק שהשנה מדברים יותר על הוראה מרחוק. לשלוח אליי כמובן דרך המייל.

מיקי: דפנה תשלחי שוב את העבודה עוד הפעם שידעו בדיוק מה מבקשים.

דפנה: אני אשלח את זה במייל שיהיה יותר בטוח שזה מגיע לכולם אבל יש מורים שכבר שלחו לי. אמילי שלחה לי. אדריאן שלח לי. חלק כבר שלחו. אמילי אוהבת צ'יקצ'אק להיפטר ממטלות, לא סוחבת. מיקי, את רוצה להגיד משהו?

מיקי: אפשר לעשות משחק קצר? אנחנו מעט אנשים או שאתם עייפים?

ג'ו: עדיף שכל אחד יגיד משהו לסיכום

מיקי: אוקיי ,אז כל אחד יגיד פה משהו לסיכום הקהילה. מה הוא למד מהקהילה? מה מיוחד היה לו השנה? או בכלל מה שאתם רוצים

דפנה: וגם כמה מילים על אנדרי, כי אני שולחת לו את ההקלטה. ג'ו אתה מתחיל, אתה היוזם כי הרמת להנחתה.

ג'ו: כן. קודם כל אני אתחיל בדברים לאנדרי. **אני עדיין מחשיב את עצמי כמורה חדש למרות שזאת שנה רביעית שלי. אבל אני עדיין לומד כל יום דברים חדשים. ואני עדיין מנסה להמציא את עצמי מחדש**. והדמות של אנדרי הייתה מבחינתי מאוד דומיננטית בכל העיצוב של: איזה מורה אני רוצה להיות? ממש! אני מזכיר אותו בכל הזדמנות. בכל ראיון שעושים לי. בכל שיחה שמדברים איתי על מהי הוראה בעיניי ולאיפה אני רוצה לקחת את הפיזיקה. אז הדמות שלו היא , בעצם שלך, כי אני אומר לך אנדרי, אתה הרי שומע את זה. הדמות שלך הייתה דמות מעוררת השראה עבורי והיה חשוב לי מאוד לומר לך את זה.

לגבי הקהילה הזאת, אני גם רוצה להשוות. ואני אומר לכם, אני מסתובב עם קולגות שלי בבית ספר בתחומי דעת שונים היסטוריה אנגלית וכן הלאה. אני חושב ואני אומר את זה בזהירות, אין דברים מהסוג שיש לנו כאן במקצועות אחרים. בהיבט של שיתוף, בהיבט של סדירות מפגשים, שיתוף ידע וחומרים, שלא קיים לדעתי בצורה כל כך מושרשת כמו שיש כאן. המפגשים האלה הם מבחינתי ממש זכות בלתי רגילה. ואנחנו צריכים פשוט להמשיך את זה, להמשיך ולפתח. יש הרבה רעיונות לשנה הבאה, שאני ארצה כמובן לשתף אתכם בתחילת השנה אם זה עובד לי או לא. זהו, רק שיימשך.

דפנה: אין כמוך ג'ו וגם אנדרי יתמוגג כשנעביר לו את ההקלטה. צביקה אתה הצטרפת אלינו ואנדרי לא יכול היה להצטרף אז אנחנו נעביר לו את ההקלטה הקלטנו את השיחה הזו כדי שנוכל אחר כך לשגר לו בנוסף למתנות שקנינו לו ונגיע אליו. אני וקרינה באופן אישי נלך אליו הביתה כדי להביא לו את זה. אתה רוצה להגיד לנו כמה מילים צביקה? כי אני יודעת שאתה אורח בכל הקהילות.

צביקה: אני נמצא עכשיו עם שלוש קהילות במקביל. אין לי מספיק מחשבים. אז אני נודד בין קהילות לקהילות כדי שלפחות אספיק להיות בכל המסיבות. אני רוצה לברך אתכם. היה כנס מדהים בזכותכם בעיקר. אנשים שמתמידים,

מגיעים, פועלים, נמצאים בתוך הקהילות אני מברך אתכם שנזכה לשנה הבאה, שנת העשור, ואני גם מאוד מקווה שנצליח. אתם לא זוכרים איך התחילה השנה. אני לא רציתי להזכיר. היא התחילה באיחור ועוד איחור ועוד איחור.

דפנה: אני חושבת שהתחלנו בדצמבר, נדמה לי.

צביקה: אנחנו שכחנו איך נראתה תחילת השנה. יש מושג שנקרא: "צרות אחרונות משכיחות ראשונות" הצרות האחרונות הם באמת צרות אז אין באמת מה לדבר על ראשונות. אני מאחל לנו שאנחנו נתגבר על כל הקשיים. שנמשיך את יכולת העבודה הקהילתית. לא סתם דיברתי על השתתפות, שזה הבסיס. לא סתם דיברתי על שיתוף וחומרים ושיתוף פעולה. המטרה היא תחושת שותפות, תחושה של קהילה. זהו . אני עובר לקהילה הבאה. אני אשאר קצת ברקע כדי לשמוע על מה אתם מדברים, כי קודם דיבר שם מישהו מאוד יפה. אז אני אשמח להמשיך לשמוע.

דפנה: זה היה ג'ו.

אמילי: טוב דפנה אני רוצה, אני רוצה .

דפנה: בשמחה אמילי

אמילי: אני רוצה להגיד לך ולאנדרי ואני כל פעם כותבת את זה גם בעבודת הסיכום, שאתם מדריכים מדהימים. הצטרפה אליכם השנה, גם מיקי , שהייתה מדהימה לא פחות. אבל השיתוף הפעולה ביניכם והכיף הזה של מה שאתם עושים לנו שמה [פריז] זה ממש ,ממש, ממש ,לא מובן מאליו. אני רוצה להגיד לאנדרי שיצליח בהמשך דרכו. אבל אני נורא עצובה שהוא עוזב אותנו. באמת, אני עצובה, כי היה לכם שיתוף פעולה ממש נהדר וזה חבל שהוא עזב אותנו. אבל ככה זה כל הפרידות קשות וגם זאת תהיה פרידה קשה ממנו. אני מקווה שיהיה לנו טוב גם בשנה הבאה בלעדיו. אם לא, נזמין אותו שיהיה חבר בקהילה.

דפנה: שיבוא, יאכל, יעשה לנו איזה הדגמה קטנה וילך לדרכו.

אמילי: הדגמה קטנה וילך לענייניו, בדיוק, למדתי לאהוב אותו. עם הסוג של הקשיחות והסוג של הרצינות והסוג של ההומור. הוא איש מדהים ממש. אנחנו אוהבים אותו מאוד. תודה רבה לכם, כולכם, באמת שאתם קהילה מדהימה. לצערי, אני פשוט חייבת לעזוב, אז תסלחו לי.

קרינה: חכי שניה רק שניה. אני רוצה להגיד קודם כל תודה לכל החברים כי זה היה מפגש שנהניתי בו ובכלל לא קוראים לזה אצלי ביומן השתלמות קוראים לזה מפגש חברים. אז באמת זה קשרים ברמה אחרת. זה עשה את הקהילה שלנו ואת המורים שלנו ואת השותפות שלנו ברמה אחרת לגמרי. אין לי שום בעיה להתקשר לכל אחד מכם, לשאול עצה ולשאול יש לך מבחן כזה? או יש לך מבחן כזה? מה את מציעה שם? מה את מציעה פה? ורמת הקשרים שלנו באמת הפכו מקהילת מורים לחברים. זה דבר אחד. עכשיו ביי אמילי. תבלי.

כעת אני רוצה להודות לאלה שיצרו את הקהילה הזאת . זאת מיקי , שהצטרפה השנה וכבר הרגישו את הרוח הנושבת החדשה והצעירה ובעלת המרץ . לדפנה ואנדרי שמההתחלה אנחנו הולכים אחריכם. לכל מקום שתלכו אליו, איפה שתגידו שהקהילה תהיה, שם אנחנו נבוא. מעבירים את כל ההשתלמות בכיף, ברוגע, תענוג פשוט תענוג . ותמיד לומדים משהו חדש לא משנה כמה שנים אני במערכת. 25 שנה אלוהים שיעזור לנו . כל פעם לומדים עוד משהו, כל פעם רואים עוד משהו .עכשיו ברשותכם נימה אישית לאנדרי כשאני עברתי מלהיות מורה למתמטיקה למורה לפיזיקה אנדרי חנך אותי. אני נכנסתי אליו לשיעורים, ישבתי כמו ילדה טובה ותלמידה טובה והסתכלתי על איך הוא מעביר. ואין מדריך טוב יותר. כשדפנה סיפרה לי שפותחים השתלמות עם אנדרי, אמרתי לה: אנדרי שלי? כי הוא שלי מתמיד. היא אמרה לי כן ואמרתי לה אני באה, לא משנה איפה זה, וזה באמת הוכיח את עצמו. הבנאדם לא מתעייף, ולא משנה כמה שנים הוא בהוראה, והוא ממציא, וחדוות ההוראה שלו זה משהו שהלוואי שכולנו נדבק בו ושלא תיגמר לנו בחיים. אז אנדרי יקירי. אני מאחלת לך שתבחר את המסלולים שטוב לך בהם, זה שאתה נהנה בהם ותלך רק לאיפה שטוב ושאתה נהנה. תחסר לנו מאוד. הרעיון של אמילי להביא אותך כיועץ פעם בחודש מצוין ,ואני מבטיחה שהכיבוד הפעם יהיה עלינו. אנחנו נורא, נורא נתגעגע ותרגיש חופשי לבקר אותנו מתי שאתה רוצה. תודה רבה, רבה, רבה, על כל השנים.

דפנה: תודה קרינה. תודה. יפה אמרת. טוב חברים עוד מישהו רוצה להגיד משהו?

ז'ק: כן אני רוצה. קודם כל אני רוצה להגיד לכם תודה רבה שיצרתם כזאת קהילה. באמת זאת לא השתלמות, זה כיף לבוא, ממש ,למשהו שאני מחכה לו, נהנה להיות בו והאווירה בין המורים באמת היא משהו מדהים שאין במקומות אחרים. ממש קהילה מאוד מאוד מיוחדת. אני גם רוצה להגיד לאנדרי תודה רבה על כל הידע וכל הסבלנות לאורך השנים וכל מה שהוא לימד אותי. אני מרגיש שממש למדתי והוא היה לי ממש מורה לחיים ואיך להיות מורה לפיזיקה. הדבר הכי חשוב שלמדתי ממנו אני חושב, **כשהתחלתי להיות מורה חשבתי שהמורה עושה את כל ה מערכי השיעור וזהו גמרנו אתה יכול ככה ללמד כל הזמן** והדבר הכי חשוב שלמדתי ממנו זה שאתה צריך כל הזמן לחדש וכל הזמן להמציא דברים חדשים וכל הזמן להשתפר. זה בהחלט קיבלתי מהקהילה ובמיוחד מאנדרי. תודה רבה לכולם ובהצלחה לאנדרי

דפנה: כבר 40 שנה מורה וכל הזמן לשדרג את עצמו אה.. ככה צריכים להיות כנראה. רק ככה לא נאבד את הברק בעיניים.

מיקי: בדיוק גם אני חשבתי על זה ואני רוצה לומר לאנדרי כמה מילים. קודם כל שאני מעריצה אותו מאז שהייתי קטנה. אני מתלהבת מזה שהוא כל הזמן מחדש. הוא כל הזמן מעניין. למדתי ממנו את ההתלהבות את זה שאני צריכה להעביר את ההתלהבות לתלמידים שלי שגם הם יעריצו את ההתלהבות הזאת. אז אני כל הזמן מחפשת אותה. וכאשר לא הייתי אתכם, הייתי בפיזיקה מחקרית אני יכולה להגיד שהייתם ממש חסרים לי בקטע של הקהילה. בקטע של לבוא כמו שקרינה אמרה זה לא השתלמות זה חברים. להיות שותפים של מורים. אתה בדרך כלל מורה בודד או שניים מקסימום עוד אחד בבית ספר וזה היה מאוד חסר לי. מאז שחזרתי זה היה לי כזה כיף. זה היה לי תענוג. אני ממש **הרגשתי שאני מחדשת את ההוראה ואני עוד פעם באה בהתלהבות לכיתה.** וזה היה נקודה מאוד משמעותית. אז שנמשיך נקווה שנה הבאה שתבוא אנדרי לבקר אותנו ותיתן לנו את ההתלהבות הזאת שוב את הניצוץ.

סטניסלב: אני רק רוצה להגיד מילה אחרונה שיהיה קצר ולעניין. קודם כל תודה רבה. אני חדש פה בחבורה ואני מודה לכם על הקבלת פנים ואני מרגיש נעים וכיף איתכם וזה לא טריוויאלי .תודה רבה דפנה ומיקי תודה רבה גם לאנדרי על כל הארגון המדהים הזה, האוכל של קרינה וכל מה שאתם עושים במהלך השנה. רואים את זה. זה לא מבוטל. לגבי אנדרי כשאני מסתכל על אנדרי אני רואה את לאונרדו דה וינצי זאת האמת. הקשר היחיד ביניהם שהוא גם מדען והוא גם צייר. אני זוכר את השאלה הראשונה ששאלתי את אנדרי לגבי רוכב אופניים שמטה את הגוף שלו. אז הדבר הראשון שאנדרי עשה הוא לקח נייר והתחיל לצייר את רוכב האופניים ואת הזווית. ועד היום דרך אגב יש לי את הציור הזה ואני שומר אותו אצלי ואני מראה לכולם ואומר זה מורה לפיזיקה ככה מורה לפיזיקה צריך להיות. הוא צייר את זה כל כך יפה את הרוכב שמוסט והוא הסביר יפה אני שמרתי את התמונה הזאת וזה בעיניי אנדרי. אז אני חושב שאם יום אחד אני אגיע להיות חצי מאנדרי אז אני אהיה מורה מושלם. אז קודם כל תודה רבה אנדרי על כל מה שעשית בשבילנו. ונקווה לראות אותך גם בהמשך. תודה רבה

סברינה: אני חושבת שאני מכירה את אנדרי יותר מכולכם מבחינת השנים. הוא היה גם שכן שלי בזמנו. אז אנדרי למרות שאנחנו לא שכנים, תמיד נפגשנו בהשתלמות ושמחתי מאוד. וכל מה שכל האנשים אומרים אני מסכימה עם כל המילים ורוצה להוסיף עוד מילה טובה. כשאני מרגישה את עצמי שאני כבר התעייפתי ואין לי כבר מה ליצור חדש אני מסתכלת עליך ואני מתפלא שלך לא נגמרים הרעיונות לא נגמרים הכוחות. רק קינאה אבל קינאה במובן הטוב. אז בהצלחה.

מיקי: גם לך סברינה לא חסר

סברינה: לא. אבל זה לא כמו אנדרי. הוא נהנה לא רק בפיזיקה הוא נהנה גם המתמטיקה.

הארי: אני רוצה לברך גם כן. האמת שקצת קשה לי לדבר כשאנדרי לא פה או לדבר אליך בעצם כשאתה רק שומע את ההקלטה. אני חושב שאנדרי ,אתה אדם אציל. אדם מיוחד. אדם עם לב רחב, לב גדול. זה נכון שאתה מבין בפיזיקה ומתמטיקה ובהרבה דברים, אבל אני חושב שהגדלות שלך היא לא בזה. הגדלות שלך היא בזה שאתה משדר את הכל ברוגע בנחת. לא במין איזה אני יודע אלה במין שמחה. אתה חי את הדברים. אתה ממש חי אותם. ואני כל פעם כשאני שומע ורואה ולומד ממך דברים אני נהנה ושמח. האמת זה זכות גדולה שהייתה לנו בשנים האלה להיות איתך ותצליח ותלך הלאה. הלוואי שנוכל לקחת חלק מהדברים שראינו אצלך וליישם אותם גם אחר כך אצלנו בעבודה המקצועית, בחיים האישיים. זה משהו פנטסטי. אז נכון שכל החברים פה בעצם הם אלה שעושים פה את הקהילה אבל אין ספק שאתה ביחד כמובן עם השותפות הנאמנות דפנה ומיקי בונים את הקהילה. אבל אין ספק שאתם צוות מנצח צוות, משמעותי ורציני ובעזרת השם נמשיך שנה הבאה כולנו ושיהיה המון בהצלחה . תודות ..

תמלול כנס הקהילות 4/4/2021 מפגש אחרון- כפול - תמלול מליאת הפתיחה- עשור לקהילות מורי הפיזיקה

<u>דוקטור סמדר לוי ראש קהילות מורי הפיזיקה בארץ</u>

רקע היסטורי-.... הקהילות פועלות במודל של מניפה שהוא מודל חלוצי לא רק בארץ אלא גם בעולם. שבו הצוות (כמו ששמעתם בברכות המקדימות) מקבוצת הפיזיקה במחלקה להוראת המדעים, גם מפתח את התכנים וגם דואג לכל הצדדים האירגוניים וגם מוביל את קהילת המורים המובילים את הקהילות כשכל רעיון חדש, כל פעילות חדשה, המורים המובילים הם החלוצים. הם בודקים אותה בכיתות שלהם. הם חוזרים עם תובנות עם הצעות לשינוי ולשיפור ורק אז אתם בקהילות מתנסים באותם פעילויות ואחר כך בכיתות שלכם וכל התהליך הזה בכל הרמות מלווה כל הזמן ברפלקציה שיתופית ובהמון הפריה וקשרים בין הקהילות השונות ובין המורים השונים בתוכנית. תודות...

ההתחלה הייתה מלווה בהרבה אתגרים בירוקרטיים... התחלנו בשנה הראשונה עם שלוש קהילות שמנו בערך 30 מורים ועם השנים גדלנו... בכנס הקהילות ב 2015 היו כבר הרבה קהילות. הכנס הזה שמתקיים אחת לשנה הוא באמת הזדמנות לראות את כולם לשמוע את כולם מדברים את אותה שפה משותפת ולהרגיש את העוצמה האדירה של קהילת כל הקהילות. אחר כך גדלנו עוד ואפשר לראות בתמונת הידיים ששייכים למורים שונים מקהילות שונות . שבאופן הכי טבעי בעולם משתפים פעולה במשהו, שכרגע זה לא משנה במה, פשוט ככה. אלו הקהילות ויש בזה את היופי.

השנה כל הקהילות מתוקשבות ואין מילים להודות למורים המובילים. איזו השקעה זו, איזו מסירות ומחויבות. עד כמה אתם נדרשים ליצירתיות ולראש גדול .באמת המון זמן ואנרגיה ואתם עושים את זה מכל הלב והנשמה. באמת תודה ענקית בלעדיכם כל הפלא הזה לא היה קורה. הכנס היום הוא גם הזדמנות לברך את כל המורים החדשים שהצטרפו השנה למשפחת הקהילות . כל מורה ומורה בתחילת דרכם חשים את הגלים בים שאליו הם נכנסים. כמה טוב שהקהילה יכולה להוות מסגרת תומכת, כשיש עם מי להתייעץ ושבכל קהילה יש גם מורים חדשים וגם מורים ותיקים שמפרים אלו את אלו. במהלך עשור מספר המורים בקהילות גדל פי 10 התחלנו 30 והיום אנחנו כמעט 300 וקרו גם שינויים בכיתות, מספר התלמידים גדל, דרכי ההוראה השתנו, האסטרטגיות, הגישות, האווירה בכיתות .הרבה מאוד דברים בהוראת הפיזיקה התפתחו ביחד עם הקהילות במהלך עשר השנים האלה. באמת מאוד מרגש לעצור היום ולהסתכל על התקופה. אנחנו שוב ושוב אומרים קהילה והשאלה מהי קהילה לומדת של מורים לפיזיקה? בסוף הכנס לפני שנתיים שאלנו אתכם מהי לדעתכם קהילה? מה המשמעות של הקהילה עבורכם? ואמרתם שם (במנטימטר) דברים כמו שיתוף תמיכה ושיתוף ושיתופיות , אם אחד חסר כולם שמים לב, משפחה חמה ,קבוצת תמיכה, בית היבט אחר של למידת עמיתים רעיונות התפתחות וחדשנות הדרך להיות מעודכן הפריה הדדית, מקום טוב למורה לפיזיקה, בית . אז באמת כשמדברים על קהילה לומדת של מורים קהילה מקצועית קודם כל מדובר על שייכות, על תמיכה, על בית מקצועי ,שזה אומר נורמות וערכים משותפים, כבוד ,פתיחות, אמון, שיתוף פעולה, זהות קבוצתית ואישית זה שאני בקהילה זה חלק ממי שאני. אחריות הדדית לכולם, להט, התלהבות ומחויבות רגשית. פעילות בקהילה היא תהליך מתמשך, שנה אחר שנה, לאורך שנים. בלמידה פעילה ושיתופית, בשיח רפלקטיבי על ההוראה והלמידה תוך התמקדות בלמידה גם של התלמידים שלנו וגם שלנו עצמנו . פתיחה של דלת הכיתה .אנחנו כבר לא לבד. אנחנו מדברים ביחד על ההוראה כבסיס לחשיבה ,להתלבטות להתחדשות וכל זה קורה קשה פיזיקה במוקד. זה הרעיון של קהילות דיסציפלינריות. המטרה של כולנו היא משותפת לקדם את הוראת הפיזיקה. ויש לנו גב אקדמי של קבוצת הפיזיקה במחלקה להוראת המדעים במכון ויצמן וזה חלק משמעותי מהשלד האיתן הזה של הקהילות שלנו. אז קהילה היא לא רק מפגש כיפי ומהנה, למרות שגם זה חשוב. זה תהליך ארוך, שיטתי ,מתמשך, של למידה וחשיבה מחודשת כל פעם, על מה הוא תפקיד המורה? מה זאת הוראת הפיזיקה? ואיך היינו רוצים שהתלמידים והתלמידות שלנו ילמדו? זאת דרך חיים למורים ותיקים, למורים צעירים, למורים חדשים, למורים מנוסים, לכולם ביחד ,מתוך הפריה הדדית, שנה אחר שנה. מאוד מרגש שיש אתנו מורים שזאת השנה העשירית שלהם או שנה שמינית בקהילה. לא כל כך משנה מתי הצטרפתם, מה שחשוב שאתם ממשיכים שנה אחר שנה. אז בקהילה השלם הוא תמיד גדול מסכום חלקיו. אני חושבת שכל אחד מאתנו זוכר את אותם רגעים קסומים שבהם משהו שכמורים לא חשבנו שאפשרי, התברר לנו כאפשרי. תודות..

Appendix E: Observation Documentation

Observation Documentation - In Participant Observation Format

- Highlighting Interesting Episodes Observed in the Meetings

Participant observation is **the process of entering a group of people with a shared identity to gain an understanding of their community**.

תיעוד תצפיות- בפורמט תצפית משתתפת- נקודות מעניינות שנצפו במפגשים

בתצפית משתתפת החוקר משתתף בחיי היומיום של החברה הנחקרת. הוא משתתף מחד וצופה מאידך. המטרה היא צבירת חוויה וידע. התצפית דורשת למידה של שפה ותרבות על ידי שהות ממושכת.

Sessions 1, 2 in 2016 are fully translated and are an example of reports from the rest of the sessions

Session 1 in the year of activity 2016

Even before the meeting began and some of the teachers did not know each other at all, conversations had already begun. This is while guards crowd around the dining table, eating, drinking and chatting. Teachers started getting to know their peers, finding out what high school they were from and whether they knew their friend who taught in the area and other such questions. Teachers have raised interesting questions around the dining table: How do you cope with a large number of students in a class? How do you make students not interfere? There were deep conversations and teachers gave advice and shared their course of action before the introductory game and before the formation. It was fun to watch them forge new connections and consult professionally with a teacher they did not know at all but have a lot in common professionally.

It was especially interesting to see how the young teachers cling to the experienced teachers and eagerly listen to their words. One of the young teachers told me at the end of the session that he felt the discussions were flooding his knowledge and he opened up for learning.

That is, **in the community the knowledge of the learners themselves is flooded and forms the basis for new learning.** I was very thoughtful of this insight.

More than **30** teachers attended the meeting. One teacher got confused and arrived at 19:15 and he actually arrived from a distance. A real shame. He did not even have food left. When it comes to food, Andrei's lab assistant has designed sumptuous dining tables. This time we decided to change the concept and raised money. NIS 100 from each teacher. That way we will not have to look for volunteers for refreshments at every meeting. I surveyed the participants and noticed that this year there is a refresh in the line of teachers. More than half, are new teachers in the community. That's why the "what a piece" introductory game took longer than expected, but was entertaining. The teachers shared personal and professional details, there was a lot of laughter and there was a very nice atmosphere right from the start. Then we moved on to the "special time" section. We asked the teachers to donate materials so that this would indeed be a "community" and not

a "lesson" with two facilitators. We explained the rationale of community and sharing. There are a lot of young teachers this year in our community and the part of "The Special Time" were an attraction for them. Everyone asked for links, explanations and we saw their enthusiasm. During the break, the talks revolved around the structure of the matriculation exam. New teachers consult veteran teachers. A community at its best. In the second part we did the marshmallow challenge which was a great success. The teachers worked in teams with people they did not know. It was wonderful to see the collaboration, professional conversations and new friendships being forged.

We then worked on the matriculation question in electricity which was planned to be in a special activity, but we did not manage to finish it towards the original design. It happens to us often. Teachers usually solve the question as students and after insights and conclusions, pass on the activity in their classroom. This time we asked the teachers to pass the question on in their classrooms and return to the next session, without the initial part in which they themselves experience the activities as learners. It goes against the rationale of the community, but unfortunately we did not keep up with the times. There was excellent and encouraging feedback. We returned, Andrei and I, very pleased with the meeting.

Session 2 in the year of activity 2016

The first part of the session was interesting for all the teachers. We watched a movie about gravity and Andrei explained the theory. The teachers were interested and asked questions. I then introduced a toy that shows the center of mass of the body. The teachers passed the toy between them.

We went out for a break and I counted those present. Usually the number of participants in the community stabilizes only after the second meeting. I surveyed the teachers who came this year and remembered that in the first year the community numbered close to twenty teachers. Every year we grew. Now in our third year, 35 teachers are enrolled in the community. In practice, 25-27 regular teachers come regularly. This year has been a dramatic change and a big turnover. Many of the veteran teachers have left the community, some also retired. The lines were filled by new teachers. Most of them are not young teachers but experienced teachers who want to innovate. There are also a large number, about a third of the participants, who are inexperienced teachers. Today I estimate over half of the teachers in the community are brand new teachers in our community.

Positive point: Karina said that today is exactly her birthday. She told teachers at her school and her family also asked her why she was going to study in the afternoon until the evening, on the day she had a birthday? And she replied: Exactly because of that!! **I have a birthday! I am going to celebrate with friends**!

These words made me realize how much **our teachers see the community as a family**.

Negative point: The academic part dealt with definitions and concepts. An argument started between the teachers. The tones went up a lot. A teacher asked, Andrei answered and many teachers got into his words. There was noise and chaos and no one listened to the other. Teachers started arguing with the teacher sitting next to them. It took me about five minutes to calm the spirits and get back to the discussion. I usually do not have such moments of lack of control. I encourage dialogue between teachers as between classmates but this time no one heard his friend's words.

At the end of the session Rose approached me and said that this part of the activity was too loud and crowded for her and she did not enjoy and hope it is one-off. I really had to apologize to her. I was quite embarrassed

2016

מפגש 1 בשנת הפעילות 2016

עוד לפני שהמפגש התחיל וחלק מהמורים כלל לא הכירו אחד את השני, כבר התחילו שיחות. זאת בזמן שמורים מתגודדים סביב שולחן האוכל, אוכלים, שותים ומפטפטים. מורים התחילו להכיר את עמיתיהם, ביררו מאיזה תיכון הם והאם הם מכירים את חבר שלהם המלמד באזור ועוד שאלות מסוג זה.

מורים העלו שאלות מעניינות סביב שולחן האוכל: איך אתה מסתדר עם כמות תלמידים גדולה בכיתה? איך אתה גורם לתלמידים לא להפריע? היו שיחות עמוקות ומורים נתנו עצות ושיתפו בדרך הפעולה שלהם וזאת עוד טרם משחק ההיכרות וטרם פעולות גיבוש. היה מהנה לצפות בהם רוקמים קשרים חדשים ומתייעצים מקצועית עם מורה שכלל לא הכירו אך יש להם הרבה במשותף מבחינה מקצועית. מעניין במיוחד היה לראות כיצד המורים הצעירים נצמדים למורים הוותיקים ומקשיבים בשקיקה לדבריהם. אחד המורים הצעירים אמר לי בתום המפגש כי הרגיש שהדיונים מציפים את הידע שלו והוא נפתח ללמידה. **כלומר בקהילה הידע של הלומדים עצמם מוצף ומהווה בסיס ללמידה חדשה.** הייתי מאוד מהורהרת מהתובנה הזו.

למפגש הגיעו למעלה מ- 30 מורים. מורה אחד התבלבל והגיע בשעה 19:15 ודווקא הוא הגיע מרחוק. ממש חבל. אפילו אוכל לא נשאר לו. בעניין אוכל, הלבורנטית של אנדריי עיצבה שולחנות אוכל לתפארת. הפעם החלטנו לשנות את הקונספט ואספנו כסף. 100 שקלים מכל מורה. כך לא נצטרך בכל מפגש לחפש מתנדבים לכיבוד. סקרתי את המשתתפים והבחנתי שבשנה זו יש ריענון בשורת המורים. יותר ממחצית, הם מורים חדשים בקהילה. זאת הסיבה שמשחק ההכרות "איזה קטע", ערך יותר זמן מהמצופה, אבל היה משעשע. המורים שיתפו פרטים אישיים ומקצועיים, היו הרבה צחוקים והייתה אווירה נחמדה מאוד כבר על ההתחלה. אח"כ עברנו להצגת (הפינות) הנקודות המיוחדות. **ביקשנו שהמורים יתרמו חומרים כדי שזו אכן תהיה "קהילה" ולא "שיעור"** עם שני מנחים. הסברנו על הרציונל של הקהילה והשיתוף. הרבה מורים צעירים יש השנה בקהילתנו והפינות היו עבורם אטרקציה. כולם ביקשו קישורים, הסברים וראינו את התלהבותם. בהפסקה, נסובו השיחות על מבנה בחינת הבגרות. מורים חדשים מתייעצים מורים וותיקים. קהילה במיטבה. בחלק השני עשינו את אתגר המרשמלו שקצר הצלחה. המורים עבדו בצוותים עם אנשים שאינם מכירים. היה נפלא לראות את שיתוף הפעולה, השיחות המקצועיות והחברויות החדשות הנרקמות. לאחר מכן חילקנו את שאלת הבגרות בחשמל שהייתה מתוכננת להיות בפעילות מיוחדת, אך לא הספקנו. זה קורה לנו לעיתים קרובות. בדרך כלל המורים פותרים את השאלה כתלמידים ולאחר תובנות ומסקנות, מעבירים את הפעילות בכיתתם. הפעם ביקשנו מהמורים להעביר את השאלה בכיתותיהם ולהחזיר למפגש הבא, ללא החלק הראשוני בו הם עצמם מתנסים בפעילות כלומדים. זה נוגד את הרציונל של הקהילה, אך לצערנו לא עמדנו בזמנים. היו משובים מצוינים ומפרגנים. חזרנו, אנדרי ואנוכי, מרוצים מאוד מהמפגש.

מפגש 2 בשנת הפעילות 2016

החלק הראשון של המפגש היה מעניין לכל המורים. צפינו בסרט על גרביטציה. אנדריי הסביר את התיאוריה. המורים התעניינו ושאלו שאלות. לאחר מכן אני הצגתי צעצוע שמראה את מרכז המסה של הגוף. המורים העבירו את הצעצוע ביניהם. יצאנו להפסקה וספרתי את הנוכחים. בדרך כלל מספר המשתתפים בקהילה מתייצב רק אחרי המפגש השני. סקרתי את המורים שהגיעו השנה ונזכרתי כי בשנה הראשונה הקהילה מנתה קרוב לעשרים מורים. בכל שנה צמחנו. כעת בשנתנו השלישית, רשומים לקהילה 35 מורים. בפועל מגיעים 25-27 מורים המתמידים באופן קבוע. השנה היה שינוי דרמטי ותחלופה גדולה. רבים מהמורים הוותיקים עזבו את הקהילה, חלקם גם לגמלאות. את השורות מילאו מורים חדשים. רובם לא מורים צעירים אלא מורים מנוסים המעוניינים להתחדש. יש גם מספר גדול, כשליש מהמשתתפים, שהינם מורים לא מנוסים. כיום להערכתי למעלה ממחצית המורים בקהילה הינם מורים חדשים לגמרי בקהילתנו. נקודה חיובית: קרינה סיפרה שהיום בדיוק חל יום ההולדת שלה. היא סיפרה שמורים בבית ספרה וגם משפחתה שאלו אותה למה היא הולכת ללמוד בשעות אחה"צ עד שעות הערב, ביום שיש לה בו יום הולדת? והיא ענתה: **בדיוק בגלל זה!! יש לי יום הולדת! אני הולכת לחגוג עם חברים!** דבר זה גרם לי להבין עד כמה המורים שלנו רואים את הקהילה כמשפחה. נקודה שלילית: החלק האקדמי עסק בהגדרות ומושגים. החל וויכוח בין המורים. הטונים עלו מאוד. מורה שאל, אנדריי ענה ומורים רבים נכנסו לדבריו. נוצר רעש ובלגן ואף אחד לא הקשיב לשני. מורים החלו להתווכח עם המורה שיושב לצידם. לקח לי כחמש דקות להרגיע את הרוחות ולחזור לדיון. בדרך כלל אין לי רגעים כאלו של אי שליטה. אני מעודדת שיח בין המורים כמו בין תלמידי הכיתה אך הפעם אף אחד לא שמע את דברי חברו. בתום המפגש ניגשה אלי רוז ואמרה שהחלק הזה של הפעילות היה עבורה יותר מדי קולני והמוני והיא לא נהנתה ומקווה שזה חד פעמי. נאלצתי ממש להתנצל בפניה. הייתי די נבוכה

מפגש 3 בשנת הפעילות 2016

דיון על תכנית הלימודים. מקס ממש עולה לטונים גבוהים כשהוא מדבר על כך שהתוכנית דלה, אין בה מספיק תכנים והוא מעוניין שהפיקוח על הפיזיקה יחייב את המורים ללמד עוד נושאים ועוד נושאים. סברינה ענתה לו שבקושי מספיק הזמן ללמד את התכנית הקיימת. הוא ענה שהתלמידים יוצאים עם ידע שטחי. היא ענתה שעדיף פחות נושאים וללמד לעומק מאשר הרבה נושאים שצריך רק לרפרף עליהם כדי להספיק את כל החומר. אמילי העירה לשניהם שהם דנים דיוני סרק ואז פנתה אלי בקוצר רוח: נו, מתי מתקדמים, אין לי סבלנות לחכות שהם יפסיקו לדבר. לשמחתי לא רבים שמעו את דבריה. המשכתי את הפעילות, אך מקס וסברינה מדי פעם קטעו את דברי והמשיכו לדון במה שעניין אותם תוך כדי שאני מדברת. השתדלתי להתעלם מהם לטובת הסקירה המקצועית שהעברתי זאת בעיקר כיוון שראיתי שאף אחד פרט לשניהם, לא מתעניין בוויכוח.

מפגש 4 בשנת הפעילות 2016

רומן- **אני רוצה לשתף בביקורת שקיבלתי בכיתה**- תלמידה אמרה לי שאני שואל, ומיד נותן לתלמיד הראשון שהצביע, לענות. הרגשתי שהנה, אחרי 4 מפגשים, המורים כבר מרגישים מספיק בטחון להציף גם כשלים שלהם.

לאחר מכן סיפר על שיטת ההוראה שלו בכיתה, הוא נותן לתלמידים לדבר ביניהם ולהסביר אחד לשני. מכאן התפתח דיון ארוך ומורים רבים הציפו את שיטות ההוראה שלהם. הרגשתי שבמפגש זה, חצינו את רף החששות ממה יגידו עלי המורים האחרים.

רוז הייתה שותפה ערה בדיונים ושיתפה את כולם בתובנות מהשיעור שערכה בבוקר. היא אמרה לי משפט שגרם לי גאווה גדולה, לאחר ששיבחה את איכות הדיונים בקהילה: **הביקורת הבונה של החברים זה המנוע האמיתי שלי כמורה**. משפט זה מעיד על **הרפלקציה שהמורים עושים על עבודתם בעקבות השיח בקהילה**. לצערי הדיון גלש הרבה מעבר למתוכנן ולא הספקנו לסיים את הנושא האקדמי. חלק מהמורים לא וויתרו ונשארו אחרי שעות ההשתלמות, חלק הפציר שנמשיך בפעם הבאה כי זה נושא חשוב.

מפגש 5 בשנת הפעילות 2016

פעילות בנושא שאלה דיאגנוסטית. כל מורה ענה על השאלה לבד. אח"כ התחלקנו לקבוצות וכל קבוצה ענתה על השאלה במשותף ולבסוף התקיים דיון במליאה. כבר בתחילת הדיון במליאה, אמר מקס - אותו הגדרתי כמורה רוסי- שהוא אינו מסכים שתלמידיו יעשו עבודה בקבוצות. לדעתו כל תלמיד צריך ללמוד לבד. כשהם יחד, הם מעתיקים, אחד רק עובד באמת והשאר מעתיקים. מורים ענו לו שלדעתם יש מקום לעבודה בקבוצות. נימוקים לדוגמה: תלמיד חזק יכול לעזור כך לתלמיד חלש. תלמיד שלא הבין מספיק את השאלה, שומע את נימוקי חבריו ומבין יותר טוב ועוד.. אך למרות הדיון הפורה שהתפתח, מקס נשאר בשלו ולא השתכנע. אין למידת עמיתים. חבר לא יכול ללמד חבר. רק מורה יכול ללמד. הוא אמר משפט שקומם מורים רבים: " מי שיודע, יודע, ומי שלא יודע, לא יודע" הארי ענה: אתה לא למדת עם חברים? לא הרגשת שזה עוזר? לא עדיף שהקבוצה תלמד יחד ויגישו תוצרת משותפת? מקס השיב: לא. אני רוצה לראות את השטויות שכל אחד כותב. רוז ענתה לו שאם התלמיד החזק יכול להסביר את התשובה לחברי הקבוצה וליצור הבנה, אז העבודה בקבוצה זה ממש מעולה. מקס ענה: תלמיד חלש יעזור בשיעור פרטני. תלמיד חזק המלמד בשיעור, תלמיד חלש, זה בזבוז זמן! היה אי שקט בקרב המורים ואי הסכמה ואז הוא המשיך מקס: תלמיד חזק צריך לעבוד חזק, הוא צריך לנצל את הזמן כדי להספיק יותר תרגולים ולא להתעסק עם תלמיד חלש שבקושי יספיק לסיים בשיעור 2 תרגילים. נינה הוסיפה: למידה בקבוצה זה מפרה, זה מלמד. לאחר מכן הדיון פסק מעצמו.

מורים עבדו וענו על השאלה תחילה בעצמם וענו ואחר כך בקבוצה רק מקס התעקש ועבד לבד. סירב לחבור לקבוצות המורים שנוצרו וגם בדיון במליאה ציין שזו עבודה עצמית שלו. הוא ישב ליד קבוצת מורים, אך רק הקשיב, לא השתתף כלל. לדעתי רק מטעמי נימוס שכן ביקשתי ממנו מספר פעמים לחבור לאחת הקבוצות. השאלה הייתה גרף של האטה והמורים התלהבו מהשאלה מאוד כיוון שניתן בעזרתה לבדוק את ידיעות התלמיד. באופן כללי בקהילה יש רצון רב לעבודה בקבוצות. המורים אוהבים לדון יחד על הפתרון. כל אחד תורם את התובנות שלו. אני באופן אישי מסתובבת בין הקבוצות ובכל פעם לומדת משהו חדש וגם הפעם עלו תובנות יפות על הקשר בין הגרף לבין הסיפור של השאלה.

מפגש 6 בשנת הפעילות 2016

התקיים יריד מדע בתיכון בו אנו נפגשים. אנדריי סייר אתנו בין המתקנים, תלמידים הסבירו אופן פעולת כל מתקן תוך שימוש במונחים פיזיקליים. מורים התנסו, ישבו על המתקן, הסתובבו, דחפו ומשכו והייתה אווירת קרנבל. בסוף הפעילות הייתה הרצאה מרתקת של חוקר מתחום הביולוגיה על רדיואקטיביות, נושא שנלמד גם במסגרת לימודי הפיזיקה. המורים הסתובבו בקבוצות ולבד ונהנו מאוד ממפגש חוויתי זה והראיה לכך היא שכמעט ולא עלו למעבדה כדי לאכול והכיבוד נשאר בשלמותו..

מפגש 7 בשנת הפעילות 2016

מפגש חגיגי במיוחד נערך בקהילה. אנדריי הזמין את כולנו לכיבוד משובח, בעקבות הזכייה בפרס המורה המצטיין. היום יגיע לביקור המפקח המרכזי על הוראת הפיזיקה וזה היה נושא השיחה סביב שולחן האוכל. שיחה אחרת סביב השולחן הייתה על הפעילות שנעשתה במפגש הקודם, פעילות על הנגשת הידע לתלמידים. מקס העיר הערה שקוממה את המורים וטען שאנחנו רק צינור המוביל בין הידע של המורה לבין התלמידים ושהמורים בעצם לא מייצרים ידע. מורה צעיר ענה לו שאנחנו צריכים להיות מסננת בין הידע האקדמי לבין מה שמעבירים לתלמידים. לעיתים נראה שהמורים עייפים מההערות של מקס וגם אם הם מקוממות אותן, הם כבר לא עונים לו כדי שלא יתפתח דיון, שגם כך לא מעניין אותם, וכדי שהנושא ייסגר מהר. ניתן לראות זאת במחוות. מבט או תנועת ידיים מבטלת, שהם מפנים למי שיושב לצידם. בעודנו סביב שולחן האוכל הגיע המפקח. הוא שוחח עם הקהילה על פיזיקה מחקרית ונושאים שונים בתחום ההוראה. מורים העלו בעיות המטרידות אותם והוא ענה בסבלנות ובאריכות וניסה לתת מענה לכל הבעיות. השיחה ארכה מעל המתוכנן. נשאר ממש מעט זמן למפגש. לאחר ההפסקה המאוחרת אנדריי סיפר על הזכייה, הראה פעילויות שהוא עורך עם תלמידיו. הייתה התעניינות גדולה של מורים. ראינו סרטונים על תחרות בניית כלי שייט שהוא עורך עם תלמידיו, על עיתון פיזיקלי, על שיעורים פרטיים המועברים על ידי תלמידי יא, יב לכיתות הנמוכות ביותר. גם שיחה זו גלשה מעבר למצופה ולא הרגשנו, עד שראיתי טפטוף זוחל של מורים החוצה המתנצלים שהם יוצאים חצי שעה אחרי הזמן המתוכנן.... משמח לראות שמורים נשארו ולא הרגישו את הזמן החולף. יצאנו בשמונה וחצי. במשובים היו ביקורות טובות על המפגש ומורים הרגישו שיש אוזן קשבת ומקום לעלות בו בעיות. אכן קהילה בהגדרתה. נהנינו מאוד.

מפגש 8 בשנת הפעילות 2016

פיליפ העלה שאלה מאוד מסובכת שמצא באינטרנט. אנדריי פתר והסביר אותה על הלוח תוך שימוש במושגים אוניברסיטאיים שאינם בתוכנית הלימודים בבתי הספר. ויקטור טען שהמורים דנים בנושאים מסובכים מאוד בפיזיקה שאינם מתאימים לתלמידים. שהמורים רק רוצים להראות כמה הם עצמם בקיאים בפיזיקה ולא שכחו את מה שלמדו לפני עשרים שנה בעצמם באוניברסיטה. חזר ואמר שהוא מעוניין לקבל חומרים שמתאימים ללמד תלמידים בכיתה שכן גם כך הוא מורה לא וותיק והסיבוך שיש בפיזיקה אוניברסיטאית רק מקשה עליו להבין את הדברים הפשוטים. הוא טען שהוא בא לקהילה כדי לקבל חומרים המתאימים ללמד תלמידים ולא נושאים תיאורטיים המתאימים לסטודנטים בפיזיקה באוניברסיטה. רוז ענתה לו שכל מורה צריך לדעת מעבר למה שהוא נדרש ללמד, שלא ייתכן שהידע של המורה יהיה כמו של התלמיד ושמורה חייב להיות בעל ידע ברמה גבוהה יותר. ויקטור אמר שהוא רוצה שהילדים יאהבו פיזיקה ולא אכפת לו אם הוא מבין קצת פחות את התיאוריה, מזייף בתכנית הלימודים ולא ממש מקפיד על הוראת התאוריה. סיפר שהוא למשל לא מראה את הפיתוחים המתמטיים המובילים לנוסחה, אלא מגיש לתלמידים ישירות את הנוסחה הסופית ללא הוכחה והם פשוט מקבלים את זה. מורים אמרו לו שזה כנראה נובע מכך שהוא מורה צעיר יחסית ומתמודד עם קשיי הוראה וקשיי הפיזיקה ביחד ובמרוצת השנים כשיחוש יותר בטחון בהוראה כנראה גם הוא ייכנס יותר להוראת התיאוריה. השיחה הזאת גרמה לשיחות צד שעיקרן היה: האם לגיטימי שמורה חדש יזייף בהוראת תכנית הלימודים? חלק טענו שכך הם נהגו כשהיו מורים חדשים וחלק טענו שהוא צריך להמשיך וללמוד, להמשיך ולהתמקצע עד שיבין בעצמו את כל הדברים לעומקם ויסביר לתלמידים את התיאוריה כפי שנדרש, כלומר יפתח את הנוסחה על הלוח ולא ינחית אותה מוכנה לתלמידים שיקבלו אותה כמשהו מוגמר שאין עליו עוררין.

מפגש 9 בשנת הפעילות 2016

לקראת סוף המחצית הראשונה של המפגש, הייתה הדגמת תנועה מעגלית בעזרת צעצוע. בהפסקה כל המורים התגודדו סביב הצעצוע. העלו שאלות על זווית הפרישה, העלו רעיונות כיצד ניתן להגביר מהירות, שאלו את המורה שהביאה את הצעצוע, היכן ניתן לרכוש אותו. למרות שזאת הפסקה, הם המשיכו ללמוד ולהסביר אחד לשני תאוריות בתנועה מעגלית וניתוח תנועה בכלל. מורה שלף מתיקו מבחן שערך בנושא זה לתלמידיו, בדיוק בבוקר המפגש. המורים התלהבו מהמבחן וביקשו שיישלח קובץ אך הוא הוריד את המבחן מהאינטרנט ולכן לא היה לו קובץ, רק טופס. כיוון שלא היו לו עותקים למבחן ומורים רבים ביקשו את הטופס, אנדריי הלך בזמן ההפסקה למכונת הצילום ושכפל עותקים ממבחן זה לכל מי שביקש. המורה גם פתר על הלוח את הסעיף האחרון שנראה לכולם בעייתי. גם הסביר את דרך הפתרון וענה על שאלות. שיתוף פעולה כבר אמרנו?? חחח... כמובן שהסיטואציה גרמה להתארכות של ההפסקה ולקיצור החלק השני של הפעילות אך המורים היו מאוד מרוצים מהמבחן ומהצעצוע.

2017

מפגש 1 בשנת הפעילות 2017

הגיעו 32 מורים. שיחות פדגוגיות סביב שולחן האוכל טרם תחילת המפגש. רוב המורים מכירים זה את זה אך יש מורים חדשים. המורים משווים את מספר התלמידים בכיתותיהם. מתחיל דיון, האם לקבל הרבה תלמידים בידיעה שחלקם לא מתאימים, או לקבל מעט תלמידים אך כולם מצוינים. פיליפ טען בלהט לפני כולם, שבסופו של דבר הוא נמדד רק בהישגים של בחינות הבגרות ולכן כדי להגיע לממוצע גבוה, הוא ממיין ובוחר רק את התלמידים החזקים ומלמד כיתות קטנות ואיכותיות. קרינה ענתה לו שהיא מקבלת להגברת פיזיקה כל מי שמתעניין, גם אם היא יודעת שאולי הציונים שלו לא יהיו גבוהים, כי המנהלת שלה בודקת אותה על פי כמות התלמידים ולא על פי ממוצע הבגרות. המורים החדשים רק מקשיבים ואינם משתתפים בדיון בשלב זה. פיליפ ממשיך וטוען שלא כדאי להלהיב את התלמידים כי אז יתקבלו למגמה גם תלמידים שלא מתאימים לפיזיקה והם יסיימו את התיכון ללא זכאות לתעודת בגרות והמנהל יבוא אליו אחר כך בטענות. הוא אמר שהוא מוכן להתגמש ולגרום לכולם להתאהב בפיזיקה אך יש לו אחריות לקבל תלמידים שאכן יעמדו בהתחייבויות של התוכנית ויגיעו להישגים לימודיים נאותים. רוז אמרה בקול כועס שההורים מנהלים את המורים וגם ראש העיר. היא הוסיפה שלמורים אין יותר סמכות וביום בחינת הבגרות ההורים תוקפים אותה על הציונים. פיליפ הצדיק אותה והוסיף שהמורים תחת לחץ ואש חיה גם מהמנהל גם מהתלמידים וגם מההורים. מורה חדש סופסוף העז להתערב בשיחה ושאל האם זה מאפיין רק את מורי הפיזיקה? הארי ענה לו שפיזיקה זה מקצוע קשה ויוקרתי וההורים יותר מעורבים ויותר מקפידים מאשר במקצועות אחרים וההורים הם שמלמדים את המורה מה המורה צריך ללמד. היו צחוקים רבים. גם המורים החדשים הצטרפו לצחוקים והייתה איזושהי תחושה משחררת. תחושת אחווה שכולנו יחד.

מפגש 2 בשנת הפעילות 2017

הגיעו 31 מורים. מתוכם 2 שכלל לא נרשמו והפתיעו אותי. היה כיבוד מפנק ואווירה טובה במפגש. אנדריי הדגים צעצועים חדשים שרכש למעבדה שלו ופעילויות של ספינר על דיסק. הראה גם עוד כמה ספינרים בוורסיות שונות. במשובים, המורים ציינו שזאת פעילות טובה לקראת חנוכה. בפינת הסרטון הראנו את הסרט על ריחוף מגנטי ששלחו בקבוצת מובילים. היה דיון מעמיק על מגנטיות בעקבות הסרט ועל תנועה מעגלית בעקבות הספינר. בכלל בקהילה, המורים דנים בסוגיות שונות בהוראת הפיזיקה. היו עוד שלל הדגמות מעניינות, כל הדגמה הייתה מלווה בהסבר ואז דיון. מורים רבים השתתפו בפעילות זאת. גם החדשים. הם **בעיקר שאלו שאלות אך ניכר שהם הרגישו נוח להפגין חוסר בקיאות ולא התביישו לשאול**. כל המחצית השנייה של המפגש הייתה בעניין מפת מושגים. חלק מהמורים בעד, חלק לא ממש מכירים והסברנו שוב. סברינה הראתה את מפות המושגים שלה ושל תלמידיה. ההרצאה שלה הייתה מרתקת. המורים הקשיבו, התעניינו, רשמו וביקשו ממנה חומרים והסברים. הפעילות הזאת **גרמה לכך שמורה אחרת ניגשה אלינו וביקשה אף היא להציג משהו במפגש הבא**. משמח מאוד. **זאת המטרה בקהילה**. באחד המשובים מצאנו משפט שממש גרם לנו לשמוח, אני מצטטת אותו: ... אם יש "נקודת אור" במהלך העבודה שלי היא מפגש בקהילה.. איזה משפט חזק!! נותן לנו כוח להמשיך ומאשש את הידיעה שאנחנו עושים פה משהו באמת חשוב!!

מפגש 3 בשנת הפעילות 2017

במפגש זה היה לנו ביקור של דוקטור אסתר בגנו, החוקרת האחראית על פרויקט הקהילות מטעם מכון ויצמן. היא לא ביקרה בשום קהילה ובחרה להגיע דווקא אלינו וזה שימח אותי ואת אנדריי אם כי הכניס אותנו קצת ללחץ. למורי הקהילה שלנו יש נטייה לאחר למפגשי הקהילה והם מתווספים לאט לאט כל אחד בקצב שלו, אנדריי ביקש שהפעם יעשו מאמץ וכולם יגיעו בזמן. מורי הקהילה היו קשובים מאוד לבקשה ורובם אכן הגיעו בזמן. אנדריי נתן להם להבין שאנחנו עוברים מעין ביקורת של מדעני מכון ויצמן. רוב המפגש הונחה על ידי אסתר. היו שיחות פוריות עם המורים ששיתפו פעולה וענו על שאלותיה. אסתר הבהירה שקהילה זה לא השתלמות ועמדה על ההבדלים בין שתי צורות הלימוד. היא פנתה לסברינה ושאלה מדוע היא ממשיכה להגיע לקהילה למרות שכבר צברה גמול השתלמות מקסימלי. היא תיארה את תכנית הקהילות הארצית בה יש בכל קהילה, בכל מפגש פינות קבועות ואחר כך למידה.

סיפרה שמדעני מכון ויצמן, הגב האקדמי של הקהילות מחפשים שיטות הוראה שרגישות לקשיי תלמידים. הם מנסים להבין איך תלמיד פיזיקה חושב. היא שאלה את המורים האם הם חושבים שפרויקט הקהילות עובד. המורים כולם אישרו. היא סיפרה כי מכון ויצמן מנהל אחר הפרויקט מעקב , ביקורת וראיונות שהעלו את הממצאים הבאים: מספר המורים בקהילות גדל! בשנת 2012 היו פחות מ-50 מורים בקהילות וכיום בשנת 2017 יש כמעט 200 מורים, שהם רבע בערך ממורי הפיזיקה במדינה כולה. היא ציינה שיש תחלופת כוח אדם בקהילה, חלק פרשו לגמלאות וחלק פרשו מהקהילה וגם זה בסדר. היא הקרינה שקף במצגת בו ציטטה דברי מורים המשתתפים בקהילות. נינה אמרה: כל מה שכתוב במצגת של אסתר, אני מרגישה כאילו אני כתבתי את זה. נינה ציינה כי תלמידיה מחכים בכל יום רביעי לחומרים שהיא מקבלת במפגש הקהילה כי היא מביאה להם בכל פעם צעצוע חדש או סרטון חדש. סופיה אמרה

שהתלמידים שלה אמרו לה שהיא " קולית" כי היא משתמשת בטכנולוגיה. אסתר המשיכה לספר ואמרה שיש גידול של 15% במספר התלמידים הלומדים פיזיקה. ג'ק התערב ואמר כי יש גידול כיוון שעושים הנחות לתלמידי פיזיקה ויש לחץ מההנהלה לקלוט יותר ויותר תלמידים ללימודי פיזיקה ולא באמת משהו השתנה אצל התלמידים.

לריסה אמרה שגם כל המדיניות של העולם השתנתה לא רק פיזיקה. היא אמרה שפעם היו מקבלים מכות עם מקל על האצבעות ואחר כך הפדגוגיה התפתחה אז טבעי שיהיו שינויים. אסתר תיארה את קשיי ההתחלה בהקמת הקהילות. היא סיפרה כי קרן טראמפ הזמינו את מדעני מכון ויצמן ואמרו שהם מוכנים לממן את הפרויקט. חוקרי מכון ויצמן ענו שלא ניתן להכשיר מורה לפיזיקה אם אין לנו מורים מובילים ויזמו את קהילת המורים המובילים שתתכנס תחת המטריה האקדמית של מכון ויצמן. אך למקרות הכל קרן טראמפ הייתה סקפטית והם חששו כי אולי לא יצליחו לגרום למורים להגיע לקהילה, אולי מורים בכלל לא ירצו להשתתף בקהילות. היא ציינה כי לאחר מספר שנים קמו גם קהילות מתמטיקה וכימיה אך קהילות הפיזיקה היו הראשונות והיוו מודל בעבור קרן טראמפ. בזמן ההפסקה, המורים שאלו את אסתר שאלות רבות והייתה פתיחות רבה. האווירה הייתה שאסתר באה לביקור ולא באה לביקורת.

<u>מפגש 4 בשנת הפעילות 2017</u>

טרום מפגש, שיחות לא פורמליות סביב שולחן האוכל. מורה חדש אמר: אני רוצה לשאול את הפורום הנכבד של המורים, כי אני מורה רק מספר חודשים, מה לעשות עם תלמידים שחלשים בפיזיקה אך אוהבים את המקצוע? האם כדאי לדחוף אותם להמשיך ללמוד פיזיקה או לכוון למקצוע אחר שיותר בר השגה עבורם? אלינה ענתה לו שרוב הציון הוא בידיים שלו. רק 45 אחוז הוא הבחינה החיצונית ואמרה לו שייתן להם להישאר ויילחם בשבילם. מקס ניסה לענות אך הושתק על ידי אחרים שענו במקביל והיה קשה להבין מה כל אחד אומר.

המורה החדש אמר שבעבור אותה השקעת זמן התלמיד יקבל בפיזיקה ויכול לקבל 100 בביולוגיה, האם בכל זאת צריך להמשיך ולדחוף אותו להישאר בפיזיקה?

מקס לא מצליח להשחיל מילה כי כל המורים מדברים יחד. אמנם בטונים שקטים אך השיחה קולחת ו מקס **ממלמל: לא נותנים לדבר!**

מרק פנה אל המורה החדש והציע לו להקשיב לכל מה שהמורים אומרים אך התשובה היא כנראה משהו באמצע. במהלך הפעילות בחלק האקדמי של המפגש דיברו על מהירות התנועה של אלקטרונים. אנדריי הסביר את הפעילות ואת התאוריה ו מקס הוסיף הסבר תאורטי ארוך ומבולבל. מקס אמר שעבד ברוסיה שנים רבות **ובכל מקום נותנים לו רספקט** וכולם מקשיבים לו וכאן הוא מנסה ללמד אותנו תיאוריה אבל **הוא מרגיש שכולם משתעממים כשהוא מדבר**. יש לציין כי יש מעט אמת בדבריו. הוא מדבר עברית שבורה, הסברים ארוכים ומייגעים ובטון מונוטוני שגורם למספר מורים לאבד את הקשב לדבריו.

(ארתור) מורה הביא לקהילה טרומבון. הוא ניגן בכיתה והראה כיצד הוא מלמד את תלמידיו על הפיזיקה של המוסיקה, על התפשטות גל במיתר. מורי הקהילה נעמדו כולם ומחאו לו כפיים.

אחר כך התחילו שאלות ציניות, רוז שאלה: הכריחו אותך לנגן בכלי הענק הזה? היו צחוקים רבים

(קרינה) מורה ותיקה שאלה על מקרה שארע לה בשיעור פרטי ונראה לה שהמורה שמלמד את התלמיד בכיתה, טעה והטעה את התלמידים. התפתח דיון מעניין , מה תפקידנו כמורים פרטיים לעומת מורה הכיתה וכיצד יש לנהוג במקרה כזה

אלינה אמרה שהיא במצוקה כי מורה יצאה לחופשת לידה והיא חייבת מורה שיתחיל ללמד עוד החודש. התחילו רחשים, מורים התנדבו ותוך מספר דקות נמצאה עבודה למורה שהיו חסרות לו שעות בבית ספרו. אלינה אמרה: **קהילה במיטבה, אנחנו דואגים אחד לשני ומסדרים עבודה זה לזה. איזה גיבוש!**

<u>מפגש 5 בשנת הפעילות 2017</u>

הלבורנטית הודיעה שלא תוכל להכין לנו כיבוד במפגש זה ושתי מורות מיד התנדבו לקחת על עצמן את האירוח. המפגש התחיל בכיבוד תוצרת בית. המורות שהביאו את האוכל אפו לחם, הכינו סלטים ביתיים, אפו עוגות וקצצו פירות טריים. הכל היה בטעם ביתי, טעים ומושקע. כמובן **שכבר סביב שולחן האוכל התחיל הדיון הראשון.** המורים הביעו תרעומת על תאריכי הבגרות. הלינו על כך שכל הבגרויות מתקיימות ביום אחד ועל כך ששוב אנו אחרונים. הוויכוח נמשך גם לתוך הפעילות. הועלתה הצעה לכתוב מכתב לפיקוח ולהחתים את מורי הקהילה ואז להעביר את המכתב בין כל הקהילות ולהחתים מורים רבים. כל זאת כדי לתת לפיקוח כלי נוסף , מסמך מחאה עם חתימות של מורי פיזיקה רבים, אתו יוכלו לטעון במשרד החינוך.

בסרט שהקרנו נראה מטוס ממריא על מסלול הרצה. לאחריו שוב התפתח דיון, הפעם בענייני חיכוך. היה מעניין מאוד. רוב המורים השתתפו בשיחה והיה נחמד **לראות את המורים החדשים** (ויש לנו בקהילה מורים רבים שזו שנתם הראשונה בהוראה) **נכנסים לעובי הקורה, מתווכחים, מקשיבים, מחכימים**.

בכלל .... יש שיתוף פעולה מדהים בין מורים ותיקים לצעירים ותוכלו לראות זאת בתמונות. למשל התמונה בא אלינה, בעלת 30 שנות וותק, מסבירה למורה חדש (לא צעיר בגילו אך צעיר בהוראה, מהסבת אקדמאים) את השאלה הדיאגנוסטית שהוא התקשה להבין. היא אמרה משפט יפה: **דור וותיק מצמיח דור חדש**. למרות שחזרנו מספר פעמים על כך ששאלות דיאגנוסטיות לא מומלצות כשאלות מבחן, המורים החדשים דווקא, ציינו שהם כן משתמשים בהם. גם על זה התפתח דיון.

בפינת המעבדה, אנדריי הכין מראה גדולה וכולנו למדנו לעוף. היו צחוקים רבים. כל המורים ללא יוצא מהכלל, עמדו בתור להצטלם עם המטאטא. היה משעשע. באופן כללי **יש הרבה הומור והרבה צחוק בקהילה , מה שנותן תחושה ביתית מידיית גם למורים החדשים. הקהילה תומכת, מכילה, מעריכה ומכבדת את החדשים כמו גם את הוותיקים.** בפינת הצעצוע, אמילי הביאה מתקן של תנועה מעגלית שעבר בין כולם להתנסות.

אחרי ההפסקה הייתה פעילות על שאלה דיאגנוסטית. **מורים דיווחו איך היה בכיתות**. הרוב הגדול של המורים העביר את השאלה הדיאגנוסטית בכיתה. זה כבר היה משמח מבחינתי לראות שהחומרים מהקהילה אכן עוברים לכיתות. ג'ק טען שבשלב הנימוק, תלמידיו כתבו נימוקים שגויים, כתבו בנימוק "לא יודע" או פשוט השאירו את השורה ריקה כי לא ידעו לנמק ולהסביר את פתרונם. מורים אחרים ותיקים יותר (קרינה, הארי, אמילי, רוז, לריסה, אלינה, סברינה) ענו לו שדווקא בכיתותיהם הם מרגישים כי חל שיפור בנימוקים של רוב התלמידים ושהם משתפרים בהסברים משאלון דיאגנוסטי אחד למשנהו. הם גם ציינו כי תלמידיהם אמרו שהם אוהבים את הפעילות של שאלונים דיאגנוסטיים כי היא גורמת להם להבין יותר טוב את החומר בגלל הדרישה לנמק כל סעיף. הנימוק גורם להם להתלבטות והם לא עונים סתם מהר ובלי לחשוב. משמח לראות שהתאוריות הנלמדות בקהילה מחלחלות לכיתות ומשפיעות על הניסוח וההתבטאות של התלמידים. פיליפ אמר שהוא "קונס" בעשרים אחוז תלמיד שאינו מסביר טוב ולכן תלמידיו התרגלו להסביר את תשובותיהם ולצרף נימוק מדעי בליווי נוסחאות. הוא סיפר שתלמידיו הודו שבעקבות הקנס הם מתאמצים לנמק וזה מחדד להם עוד יותר את הבנת הפתרון. הוא הוציא שקית מבחנים מתיק העבודה שלו, שלף את המבחן הראשון והקריא לנו את נימוקי התלמיד. לאחר מכן שלף מבחן שני וגם שם הנימוקים היו רציניים, מאורגנים וברורים. לטענתו זה רק עניין של הרגל וכיוון שהוא מוריד ניקוד על נימוק שגוי, תלמידיו מתאמצים יותר. ניתחנו בקבוצות את תשובות התלמידים, את הטעויות, הנימוקים וההסברים. נציג מכל קבוצה שיתף במליאה את תובנות הקבוצה. לאחר מכן פתרנו שאלה דיאגנוסטית נוספת ביחד, הפעם בחשמל. עמדנו על טעויות ועקרונות **ושלחנו אותם לביתם שוב עם עבודת בית, להעביר את השאלה בכיתה**. היה דיון פורה על שדה חשמלי. הגדרה והסברים. מורים הציגו אסטרטגיות שונות בהן הם מלמדים את הנושא. בסוף, הוויכוח עלה לטונים לא נעימים כשאחד המורים היותר מבוגרים סרב לקבל את העניין וטען שיש רק דרך אחת להציג נושא. דרך נוסחאות. אנדריי נאלץ להתערב בוויכוח, טען את טיעונו והוויכוח הסתיים.

המורים פרגנו במשובים. ממש מחמם את הלב לראות **שמורים ותיקים מוצאים עניין, משתפים פעולה, מבצעים מטלות כשעמדת המוצא איתה הגיעו הייתה שאין מה לחדש להם**. בשיחה בסוף, בסוף, בהליכה לכיוון הרכבים, על **תאריכים לא נוחים שאולי נחליף למפגש מתושב, אמרה לי רוז: " לא. לא מפגש מתוקשב. ממש כייף להיפגש. אפילו שאני מגיעה מרחוק."** איזה משפט סיום!! נותן כוח ומוטיבציה להמשיך הלאה.

מפגש 6 בשנת הפעילות 2017

(סברינה) מורה חיתנה בן והביאה למפגש הקהילה עוגות ויין. היא אמרה: אתם כמו משפחה, חייבת לשתף אתכם גם בשמחות הפרטיות שלי. המורים היו סביבה. היא הראתה אלבום עם תמונות משפחתיות מהחתונה. כולם החמיאו לה על השמלה שלבשה באירוע. הייתה אווירה מחבקת במיוחד. אף אחד לא נותר אדיש, כולם ברכו אותה. היא ציינה שלא הביאה עוגות לתיכון בו היא עובדת. הביאה רק לקהילה. זה חידד לי את המחשבה: **עד כמה הבית המקצועי הפך למורים גם בית שיתופי, קהילתי** ולא רק פיזיקה. מקום בו אפשר לחלוק גם אירועים משפחתיים ולא רק אירועים מקצועיים

מורה חדש הציג שיטת הוראה בה הוא מנהל את הכיתה שלו בגוגל. נדרשה הרבה התמצאות טכנולוגית ומחצית ממורי הקהילה כבר מבוגרים ופחות התחברו לאופי זה של הוראה. למרות שהנושא לא התאים לרבים מהמורים, עדיין במהלך ההרצאה הייתה הקשבה, היה שיח מכבד ולא היו פטפוטים. מורים שפנו אל המרצה בשאלות, התנצלו מראש שהם לא מזדהים עם שיטה זאת אך שאלו שאלות ענייניות ולא בנימה שלילית. רק מורה אחד, מבוגר, עלה בטונים אך אנדריי שלח לעברו מבט נוזף וזה ריסן מידית את התגובה. מקס שהינו המבוגר ביותר בחבורה וברור היה ששיטה זו אינה לרוחו, ביקש לדבר. אנדריי שחשש מטון שלילי הקציב לו רק 3 דקות וטען שאנחנו קצרים בזמן. הוא טען את מה שטען ורוב המורים חייכו בסלחנות ורובם לא באמת הקשיבו למה שהיה לו לומר בעניין.

רוז הראתה פעילות מעבדה שהיא יצרה בהשראת המעבדות של אנדריי. היא הקרינה תמונות וסרטונים של תלמידי כיתתה מבצעים את הניסוי ומסבירים לחברי קבוצתם את מה שהם עושים. התלמידים דנו בינם לבין עצמם, בקבוצות על תוצאות הניסוי. היה מאוד מעניין לצפות בהם ולראות אינטראקציות חברתיות בין תלמידים חזקים לחלשים. מרק אמר: **תודה רבה על השיתוף. אני מרגיש שאני מגיע לכיתה שלך. לא ברור מאליו שאת ככה חושפת בפנינו את הקשיים של תלמידייך.** לאחר מכן התפתח דיון בנושא הניסוי. האם יש לאפשר לתלמידים לייצר לעצמם הוראות ביצוע או עדיף שהמורה יכין עבור כולם את אותו ניסוי, ללא גמישות. היו דעות לכאן ולכאן וסיכמנו שנבצע ניסוי כזה באחד המפגשים וניתן למורים להתנסות ולהחליט מה עדיף לאחר שיתנסו כתלמידים בדילמות שעלו בניסוי של רוז.

<u>מפגש 7 בשנת הפעילות 2017</u>

השיחות סביב שולחן האוכל נסובו כמו בפעמים הקודמות על הקמת המרכז המדעי החדש. מורי הפיזיקה המגיעים מאותה עיר הם כמחצית ממורי הקהילה ונושא זה מקומם אותם ובכל מפגש הם כועסים, ומתווכחים על הנושא. הפעם הרוחות היו כה סוערות שגם כאשר המורים התיישבו לחלק האקדמי , עדיין קבוצת המורים ההיא המשיכה לדון בבעיותיה. הקולות היו רמים והפריעו למהלך המפגש. ג'ו פנה אליהם וביקש שלא יפריעו. הוא אמר להם שבכל מפגש הם משוחחים על העניינים הפרטיים של עירם ושאינם נוגעים לשאר חברי הקהילה. הוא פנה לפיליפ: " נושאי השיחה חייבים להיות משותפים לכל הקהילה, לא ייתכן שחצי ממורי הקהילה בדיונים סוערים והחצי השני משתעמם. אתם יכולים לדון בזמן ההפסקות אבל לא על חשבון זמן הלמידה" פיליפ התנצל והתיישב אך שאר החבורה לא הפסיקה להתווכח למרות בקשותיו של אנדריי. ג'ו פנה אלי ואל אנדריי ודיבר בקול רם כדי שהחבורה תשמע: "אנדריי ודפנה, לא באתי לכאן כדי לקטר אלא ללמוד. לא מעניין לשמוע כל מפגש על הצרות שלהם, הם גולשים מחוץ להפסקה וזה זמן מבוזבז של למידה". הייתה שתיקה ואז כל המורים התיישבו לחלק האקדמי אנדרי ואנוכי נרגענו, כי הוויכוח יצא משליטה.

בפינה "מהכיתה שלי" תלמיד של אנדריי הציג בפנינו. בתום ההרצאה, המורים נעמדו ומחאו לו כפיים. היה ממש מעניין. מדי פעם אנדריי מביא תלמידים שלו, לדבר בפנינו והפעם היה מוצלח במיוחד כי הוא ביצע הדגמות ושיתף מורים כך שהיה משחק תפקידים הפוך, התלמיד לימד את המורה.

כמנהגי, אני תמיד בוחנת את תגובות המורים וגם הפעם, למרות שהייתה פעילות מעניינת ביותר, עדיין רומן, ישב בשולחן האחרון ובדק מבחנים. הוא נוהג לעשות זאת בכל מפגש, לשבת בסוף הכיתה, שלא יראו אותו ולכאורה לנצל את הזמן כדי לבדוק מבחנים. בהתחלה הייתי לוקחת את העניין הזה באופן אישי ואף פניתי אליו ושאלתי אם משעמם לו והאם הוא בודק מבחנים כדי להעביר את הזמן. הוא ענה לי שיש לו ילדים קטנים בבית והוא מגיע לקהילה כדי ללמוד וגם כדי לנוח, אך חייב להספיק הכל ולכן באוזן אחת מקשיב לפעילות הקהילה ובאוזן השנייה עסוק בענייניו, יש לציין שהוא גם ממעט להשתתף בשיחות וגם בהפסקה ממשיך בעיסוקיו.

<u>מפגש 8 בשנת הפעילות 2017</u>

הצטרף אלינו מורה מקהילה אחרת. הוא החסיר מספר מפגשים בקהילה שלו וחשש שלא יצליח להשלים את השעות לצורך צבירת גמול השתלמות. רוב מפגשי הקהילות מתקיימים במקביל באותו יום ובאותה שעה בכל רחבי הארץ, ימי שלישי החל משעה 16. הקהילה של המורה הארוח נפגשת בימי ראשון והקהילה שלנו בימי שלישי ולכן קיבל אישור להשלים שעות במפגשים בקהילה אחרת ובחר בנו בגלל היכרותו עם הארי, מורה בקהילה. בתחילת המפגש הצגנו אותו והוא סיפר שהוא מורה יחיד בבית ספרו וכבר שלוש שנים בקהילה וציין שהקהילה היא המקום היחיד שבו יש לו הזדמנות להיפגש עם מורים אחרים לפיזיקה, לשתף ולהתייעץ עם מורים לפיזיקה. הוא סיפר על המפגש האחרון בקהילתו והמורים הופתעו שהתוכן היה זהה לקהילה שלנו. אנטון אמר שעד שהתקבע בקהילה שלנו הוא עבר בין כמה קהילות וזה מדהים לראות איך בכל הקהילות, כל מורי הפיזיקה מדברים באותה שפה. אני הוספתי כי התוכן הכללי הוא זהה בכל הקהילות, אך כל קהילה נותנת את הפרשנות שלה ולכן הנושאים זהים אך הפעילויות שונות. דניאל אמר שאצלנו הפרשנות הולכת תמיד לכיוון מעבדה כי זה הנושא שאנדריי הכי אוהב. אנטון הגיב ואמר שלכן הקהילה שלנו מצאה חן בעיניו והחליט להישאר, כי גם הוא מחובר יותר לנושא המעבדות. המורה החדש אמר שהוא מרגיש שהקהילה זה הבית המקצועי שלו והוא נהנה מהשיתוף עם מורים אחרים. אנטון ציין שגם הוא נהנה בעיקר מהחברותא ואמר שלמרות שיש ביננו לעיתים חילוקי דעות ולכל מורה יש כאן דעה אחרת, אך כולנו יחד מתקדמים לאותה מטרה ובאותו כיוון. המורה בהתחלה היה צמוד יותר להארי אך לאחר ההפסקה כבר שוחח בנינוחות עם מורים אחרים ונראה כי התאקלם מהר.

<u>מפגש 9 בשנת הפעילות 2017</u>

בנקודות אור, רוז סיפרה שהשתמשה בדפי עבודה בנושא "השראה" שקיבלה מדניאל ושהשיעור היה מוצלח מאוד. היא אודתה לדניאל על ההדרכה שנתן לה, איך ללמד עם הדפים וכיצד לסכם איתם את הנושא. היא אמרה שהחלק הכי טוב בקהילה לדעתה הוא **שאפשר לשאול מורה חבר בלי להתבייש.** שאפשר ללמוד מעמיתיך המורים, להתלבט ביחד, לדון באפשרויות ההוראה ולחלוק תובנות. היא

הוסיפה וסיפרה שהנושא של "השראה" לא היה ברור לה עד הסוף ובכל שנה כשהיא לימדה את הנושא היא די התחמקה וניסתה רק לסיים אותו במהרה ולא נכנסה לעומק כי חששה שהתלמידים ישאלו אותה שאלות שהיא לא תדע לענות עליהן. היא אמרה שההסבר של דניאל ארגן לה את הידע וציינה שהמפגש בקהילה תורם לאיכות ההוראה שלה באופן משמעותי כי היא מצליחה ללבן דברים לא ברורים. דניאל ציין שהשיתוף הוא החלק החזק בקהילת פריז ושהוא גאה להיות חלק מהקהילה הזאת. סברינה אמרה שהחומרים שמשתפים כולם אינם מתאימים לכל אחד וכל מורה צריך להתאים לעצמו את החומרים שהוא מקבל בקהילה. היא אמרה שהיא לא מתחברת לכל הנושאים וכל האסטרטגיות הנלמדות והוסיפה **שכדי שמורה ירצה להכניס חידוש לכיתה שלו הוא צריך קודם להתנסות בעצמו ואז להחליט אם הוא אוהב ורוצה לקחת זאת לכיתתו**. אנדריי אמר שאם לא חושש להשתמש בכל **החידושים, לאט לאט הם הופכים לחוזקים שלך ונכנסים לשגרת ההוראה** שלך

2018

מפגש 1 בשנת הפעילות 2018

הצטרף אלינו השנה מורה חדש, מבוגר , כמה שנים לפני פנסיה, וותיק מאוד, מלמד מעל 40 שנה. הוא היה די שקט בתחילת המפגש. דיבר ברוסית רק עם המורים דוברי רוסית ועם אנדריי כמובן ולא ניסה להתחבר לשאר המורים, גם בהפסקה. במחצית השנייה, האקדמית, דיברנו על תכנית הלימודים החדשה שהונחתה עלינו, על ידי הפיקוח על הפיזיקה. הבהרנו מה הנושאים החדשים שנדרש ללמד, הראינו שאלה דיאגנוסטית בנושא החדש והמורים התעניינו מאוד. בתום החלק הזה של הפעילות המורה החדש ניגש אלי ואמר: **" אני חושב שהפסדתי הרבה כשלא באתי לכאן בכל השנים האלה של הקהילה. תמיד היו לי תירוצים, למה אין לי זמן להגיע. ההפסד כולו שלי"** הוא המשיך ואמר לי שהוא בקיא מאוד בחומר, מלמד אותו בעל פה, ללא ספר, ותמיד חשב שאין לו יותר מה ללמוד. ציין שמאוד נהנה מהלמידה בקהילה ומהשיתוף של המורים האחרים ואמר שרק כעת הוא מרגיש כמה הוא יכול להתחדש בהוראה שכן הוא מלמד באותה דרך כבר שנים רבות ללא גיוון כלשהו והוא התחיל לשעמם גם את עצמו. הוא סיפר כי הרגיש שהתלמידים לא בוחרים ללמוד פיזיקה בתיכון שלו, כיוון שהמוניטין של המקצוע לא גבוה, ומפה לאוזן עוברת השמועה שפיזיקה הוא מקצוע קשה ומשעמם. לכן יש לו פחות מעשרה תלמידים בכל שנה והוא החליט לרענן את ההוראה שלו. הוא שיבח מאוד את המעבדה בה אנו נמצאים. מעבדת הפיזיקה של אנדריי ואז אנטון ענה לו: גם אני הרגשתי כך כשבאתי בפעם הראשונה לקהילת גן יבנה. **התחושה הכי בולטת בהגעה להשתלמות, הייתה התחושה של בית**. שזה מדהים, **הגענו למעבדה אחרת , כיתה אחרת, שהיא מקום אינטימי של המורה, וראו טוב טוב על הקירות שזה המקום של** אנדריי **ובכל זאת הרגשתי בבית.** תודה רבה על זה.

מפגש 2 בשנת הפעילות 2018

בפינה "מהכיתה שלי", המורים משתפים בטכניקות הוראה. מורה ותיק אך חדש בקהילה הציג את עצמו, סיפר מאיזה בית ספר הגיע, מהו הרקע האקדמי שלו ואז הראה את השימוש בגוגל פורמס כפלטפורמה שונה להוראה. היה מאוד מוצלח. מורים שאלו שאלות וההדגמה הפכה חיש קל להיות סדנא. המורה עבר בין כולם. עזר לכל מורה ומורה להתנסות. לחלק מהמורים היה קשה ללמוד תוך שימוש בטלפון הנייד ולכן הוא חיבר אותם לאחד מהמחשבים הרבים שיש במעבדה. המורה הנחה בסבלנות רבה גם את המורים שקשה להם עם הטכנולוגיה. הסדנה התארכה הרבה מעבר לזמן המתוכנן ובסופה גם קיבלנו ממנו מסמך כתוב ובו הדרכה צעד אחר צעד. מורה אחת אמרה לו שמרגע זה הוא ממונה להיות העוזר הטכנולוגי של הקהילה. הוא הסכים בשמחה וכבר גלשנו להפסקה ונראה היה שמורים רבים פנו אליו גם בהפסקה וגם אחר כך, בבקשות עזרה לגבי פלטפורמות למידה אינטרנטיות. יש לציין, אנדריי ואנוכי פחות מתמצאים בתחום וזה ממש מקל שיש מישהו שיכול לקחת עליו את החלק הזה, בניהול הקהילה. כפי שראוי שיהיה, מקור הידע לא נמצא רק אצל המנחים. בסדנה הזאת אנדריי ואני השתתפנו כמורים רגילים ואף שאלנו שאלות לא מתמצאות כמו כולם. היה מעשיר מאוד וכולם יצאו עם משהו חדש למחר בבוקר לקחת לכיתה

מפגש 3 בשנת הפעילות 2018

(אמילי) מורה המעשנת הרבה ויוצאת בכל מספר דקות להפסקה כדי לעשן, כל הזמן מזרזת אותי: נו, נו, תתקדמי. מדי פעם פונה למורים: שיהיה כאן שקט. כשהיא יצאה לאחת מהפסקות העישון, רוז אמרה שהיא כנראה עצבנית בגלל הניקוטין. הייתה אווירה קצת לא נעימה, אם כי רק למספר דקות. (פיליפ) מורה צעיר אך בכיר, כעשר שנות הוראה, נעמד ליד הלוח במחצית השנייה ואמר: אני רוצה להפנות **שאלה לקהילה**. זה היה אקט יפה. **הוא לא הפנה שאלה למובילי הקהילה**, אנדריי ודפנה, אלא לקבוצת המורים כולה, לקהילה. הייתה לי קורת רוח מהדברים

מפגש 4 בשנת הפעילות 2018

אנדריי חלה מאוד. הוא סיפר לנו כבר לפני שבועיים שמצאו לו גידול והוא בבדיקות. לפני כשבוע הוא שלח מייל לכל מורי הקהילה ושאל אם יש מורה המעוניין להגדיל את משרתו ולעבוד במקומו כיוון שהוא יוצא לחופשת מחלה ארוכה וחושש שלא יוכל לחזור ללמד. בתחילת המפגש הוא ביקש ממני לתת לו חמש דקות כדי לדבר על הנושא. אנדריי סיפר שדניאל, מורה מהקהילה, נענה לבקשה במייל והגיע לפגישה עם מנהלת התיכון שלו [של אנדריי]. דניאל סיפר למנהלת שהוא עובד בתיכון בדרום הארץ ועובד בערב גם במכללה לטכנאים. דניאל אמר למנהלת שהוא מוכן להתפטר מעבודתו וללמד את התלמידים של אנדריי כדי לא לקלקל להם את שנת הלימודים ואת הבגרות בפיזיקה. אנדריי סיפר לכולם שכשהמנהלת ציטטה לו את דבריו של דניאל, היו לו דמעות בעיניים. הוא אמר לנו: **אנחנו יותר מקהילה. זה ממש משפחה. אח תומך באח**. אנדריי היה מאוד נרגש

מפגש 5 בשנת הפעילות 2018

עקב מצבו הרפואי של אנדריי, לא התקיים מפגש. במקומו, ניתנה למורים משימה להגשה שיש בה למידה עצמית. המורים ביצעו את המשימה אך ציינו שחסר להם מאוד המפגש פנים אל פנים.

מפגש 6 בשנת הפעילות 2018

בנקודות אור אמר אוליבר "**הייתי חולה 3 ימים, לא הלכתי לבית הספר ללמד, אבל לקהילה הייתי חייב לבוא".** מאוד התרגשתי מהמשפט הזה המעיד עד כמה מפגשי הקהילה חשובים לו. אנדריי במצב גופני ירוד, לא מאוד פעיל במפגש הזה, בעיקר יושב, אמר שהוא מגיע לקהילה כי המפגש עם המורים מחזק אותו ומוסיף לו בריאות.

סופיה, חדשה בהוראה, ענתה לו שגם היא לא מפסידה שום מפגש ומרגישה שהיא בונה כאן את עמוד השדרה המקצועי שלה. היא ציינה שהיא משאירה את ילדיה הקטנים עם בעלה וזה לא פשוט בכלל להיעדר עד הלילה לאחר יום עבודה מלא שבסיומו גם יש השתלמות. אך למרות הכל היא ממשיכה להגיע שכן מרגישה שהרווח המקצועי גובר על העניינים האישיים שלה בבית.

בעקבות זה, החל דיון על הקהילה וקרינה, מורה בכירה, אמרה שהמפגשים בקהילה עם המורים האחרים נותנים לה ידע נוסף בהוראת הפיזיקה כמו גם שיטות הוראה חדשות ומאגרי מידע חשובים אך בעיקר היא מרגישה שהיא מקבלת תמיכה נפשית בתהליך ההוראה. סופיה ענתה לה שכמורה חדשה הקהילה מהווה עבורה מסגרת לתמיכה. תמיכה פדגוגית ותמיכה בנושאי הפיזיקה. היא אמרה שבמפגש היא יכולה לשתף בחוויות מהכיתה שלה ומההוראה שלה וללמוד ממורים אחרים. היא ציינה שיש לה תינוקת ודי קשה לה לעזוב את הבית בשעות הערב ולהגיע לקהילה אך בסוף כל מפגש היא אומרת לעצמה "היה כדאי". כלומר סופיה שיתפה את הרווח שהיא מרגישה בהגעה לקהילה, למרות השעה הלא נוחה וסיכמה בכך שההגעה לקהילה כדאית ולכן היא ממשיכה להגיע באופן קבוע. רוז ציינה שגם היא מגיעה מרחוק אך היא הרוויחה גם בפאן החברתי ורכשה לעצמה חברות חדשות שאינן רק עמיתות למקצוע אלא חברות ממש. הן נפגשות יחד גם מחוץ לשעות הקהילה ומארחות זו את זו בבתיהן.

מפגש 7 בשנת הפעילות 2018

אנדריי ביקש לפתוח את המפגש. הוא סיפר לכולם שהבדיקות האחרונות, לאחר הניתוח, יצאו תקינות והוא חוזר לתפקוד מלא כולל כמוביל קהילה. המורים שמחו מאוד שכן לאחרונה היה מאוד פסיבי במפגשים וניכר עליו שהוא חלש. המורים בירכו אותו ו ג'ק פנה אלי ואל אנדריי ואמר שאנחנו, כמורים מובילים, מצליחים לתת לו השראה להיות מורה יותר טוב ממה שהוא. שהוא יחסית צעיר בהוראה, אך כשרואה את הלהט שלנו, מבין שזו הדרך בה מורה צריך ללמד וזאת הדרך להתמיד ולהישאר בהוראה. הארי אמר בעקבות זאת שהפעילות במפגשים גורמת למורים לצאת מהמסגרת אליה הם רגילים ומאלצת אותם להיות מורים יותר טובים, יותר מעניינים ויותר עדכניים ממה שהם כיום. הוא אמר שטבע האדם הוא ללמוד ותמיד לנסות להיות יותר טוב מאשר הנקודה בה הוא נמצא. הוא אודה לי ולאנדריי על שאנחנו עוזרים לו ולכלל מורי הקהילה להתפתח, להתקדם ולצמוח מבחינה מקצועית תוך הנאה גדולה ולמידה מתמדת. הוא אמר, אנדריי ודפנה אנחנו כולנו כאן יודעים כמה שעות עבודה נדרשות כדי לקיים מפגש קהילה כל כך מפרה והנכונות שלכם להמשיך ולייצר פעילויות, מפגש אחר מפגש, שנה אחר שנה, כלל לא מובן מאליו.

מפגש 8 בשנת הפעילות 2018

מחצית שנייה של המפגש, החלק האקדמי, עסקנו בנוסחאות מסובכות שיש בהם הזנחות רבות שאינן בתוכנית הלימודים והצענו למורים לוותר על פיתוח הנוסחאות ולהגיע ישר לנוסחה הסופית: המורה הרוסי (מקס) עשה בלגן, הוא התפרץ: למה צריך ללמד

נוסחה חלקית? זאת בעצם משוואה דיפרנציאלית, אני יודע שתלמידים לא יודעים את זה, אך אנחנו המורים כן יודעים וצריך להראות לתלמידים את כל הפיתוח על הלוח, גם אם ייקח שיעור שלם.

היו התנגדויות רבות לדבריו ואז אחת המורות (אמילי) הרימה קול וצעקה עליו שהוא מפריע למובילים ללמד.

המורה נעלב, יצא החוצה ואמר: אני הולך. אם אני אלך לא יהיה בלגן.

השיעור נקטע, המנחים ניסו לשכנע אותו לחזור אך הוא סירב והלך. הייתה אווירה עכורה. אף אחד לא העיר למורה שצעקה אך היא בעצמה לא הרגישה נוח והתנצלה. מזל שזה היה לקראת סוף המפגש והעניין הסתיים לאחר כרבע שעה.

<u>מפגש 9 בשנת הפעילות 2018</u>

במהלך דיון על בחינת הבגרות במעבדה הטונים עלו. אנדריי שהראה שיטות שונות להדגמת אותו ניסוי, התרגז פתאום ואמר שצריך לקבל את חוות דעתו של כל מורה ולא לקפוץ ולהתנגד על כל דבר. הוא הוסיף ואמר למורים, צריך להקשיב לדברים של החברים גם אם לא תמיד נראה לך שזה נכון. תן לו לסיים לדבר ורק לאחר מכן תגיד את מה שישי לך לומר, אל תתפרץ באמצע דברי חברך. המורים הקשיבו, הפנימו מספר דקות אך שוב היו ויכוחים והתפרצויות אחד לדברי השני. זה קורה בדרך כלל כאשר עולה נושא טעון כמו הפעם. כיוון שדיברנו על בחינת הבגרות במעבדה ההולכת וקרבה. לאחר מכן ביצענו ניסוי מוכר אך בצורה חדישה. על ידי פעילות של מעבדה מזמנת חשיבה. בפעילות זו אין לתלמידים תדריך מסודר כמו בניסוי מסורתי והם מתבקשים להמציא נושא לחקירה על פי הציוד העומד לרשותם. המורים התנסו כלומדים במעבדה מזמנת חשיבה בנושא חשמל. בתחילה הם לא היו שבעי רצון, לא שיתפו פעולה והתלוננו שהם לא יודעים מה לעשות עם הציוד. לאט לאט כל קבוצה מצאה נושא ייחודי לחקור, הם ביצעו מדידות וחישובים והייתה פעלתנות רבה. בסוף הפעילות, נציג מכל קבוצה הציג במליאה את הניסוי. בשלב זה כולם ללא יוצא מן הכלל, שיבחו את הפעילות שגרמה להם לצאת מאזור הנוחות ולבצע ניסוי חדש בלי להסתמך על ניסוי מוכר וידוע. הם טענו כי לתלמידים זה יהיה אפילו יותר קל כיוון שאינם מקובעים לתדריכים המסורתיים ואינם נדרשים להסתגל.

בסוף המפגש דיברנו על הצלחות. מורים שיתפו חוויות של הצלחה כגון: העלאת מספר לומדי הפיזיקה, העלאת מספר הבנות ועוד. רוז סיפרה על הכיתה שהיא מלמדת והגדירה אותה כסיפור הצלחה. סיפרה שיש קבוצה גדולה של תלמידים חזקים שמושכת את כל הכיתה קדימה. בזכותם היא מצליחה להתקדם בחומר בקצב מהיר אך לא לאבד תלמידים בדרך. היא אמרה משפט שמאוד ריגש אותי: כשיש לי כיתה של אלופים אני פשוט מתמוגגת. אני רצה איתם קדימה ומרגישה את הרוח על הפנים.

Appendix F: Expectations Questionnaire

Expectations Questionnaire at the End of the First Meeting in the Paris Community and at the End of the Year of Activity in the Paris Community

Expectations Questionnaire at the End of the First Meeting in the Paris Community	Expectations Questionnaire at the End of the Year of Activity in the Paris Community
What is your opinion on the idea of a learning community of teachers?	What is your opinion on the idea of a learning community of teachers?
What do you expect from your participation in the Paris Community?	Did participation in the Paris Community meet your expectations?
Which support would you want to receive in the Paris Community?	Did you receive support in the Paris Community?
Would you recommend to a friend to participate in the Paris Community?	Would you recommend to a friend to participate in the Paris Community?
How do you feel in the Paris Community?	How did you feel during the year of activity in the Paris Community?
What causes you to come to the Paris Community?	What caused you to come to the Paris Community?
Does it seem to you that you will derive benefit from belonging to the Paris Community?	Does it seem to you that you derived benefit from belonging to the Paris Community?
Which contents conveyed in the community can help you with diversifying the teaching of physics in the classroom?	Which contents conveyed in the community helped you with diversifying the teaching of physics in the classroom?
Do you believe that you will hold in class an activity that you got to know in the framework of the community?	Did you hold in class an activity that you got to know in the framework of the community?
In your opinion, can the discourse in the community on the teaching of physics contribute to teaching?	In your opinion, can the discourse in the community on the teaching of physics contribute to teaching?
Would you like to be a leading teacher?	Would you like to be a leading teacher?

Appendix G: Feedback to the Paris Community Meeting

Feedback to the Paris Community Meeting

WEIZMANN INSTITUTE OF SCIENCE
המחלקה להוראת המדעים
Department of Science Teaching

LEARNING COMMUNITIES

THE TRUMP FOUNDATION
קרן טראמפ

Feedback to the Paris Community Meeting

Name-(optional): ..... date: .....

So what did we have today?

1)What was significant to you at today's meeting, and why?

.....

.....

2)What do you find useful in the classroom, and why?

.....

.....

3)What were you missing in the meeting?

.....

.....

4)What else would you like to say about the meeting?

.....

.....

Thank you!

Appendix H: Open Feedback to the Paris Community Meeting

Open feedback to the Paris Community Meeting that includes an example of a teacher response and a translation of the response

WEIZMANN INSTITUTE OF SCIENCE
המחלקה להוראת המדעים
Department of Science Teaching

LEARNING COMMUNITIES

THE TRUMP FOUNDATION
קרן טראמפ

Open feedback for the Paris Community Meeting

Name-(optional): ..... date: .....

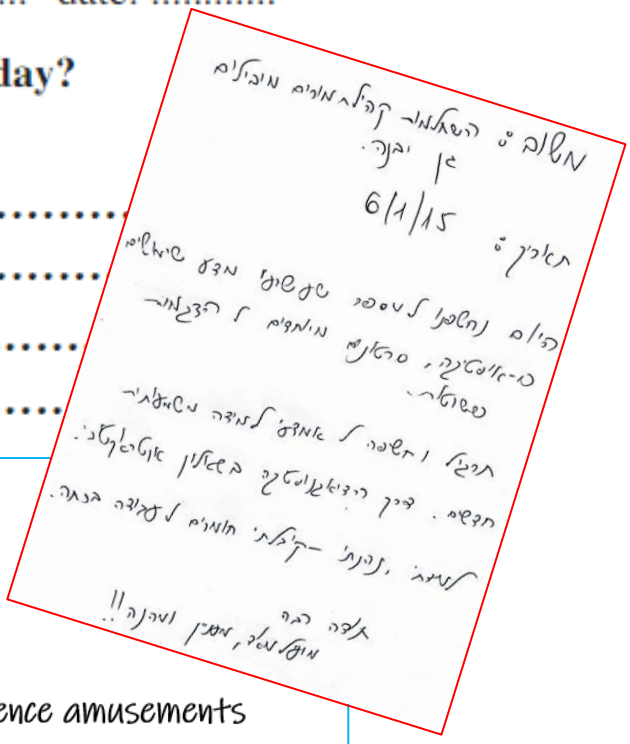
So what did we have today?

.....

.....

.....

.....



Feedback: Professional learning community

Paris

Date: 6/1/15

Today we were exposed to a number of useful science amusements

In-optics, special videos for simple demonstrations.

Practice and exposure to new means of meaningful learning,

Through diagnostics in an interactive questionnaire.

I learned, I enjoyed - I was given materials suitable for classroom work.

Thank you

Very helpful, interesting and fun!!

Appendix I: A Collection ofPhotos from Community Activities