

BAR-ILAN UNIVERSITY

**The Characteristics of Physics Teachers Attending a
Professional Learning Community in terms of their
Collegial Interactions, Perceptions about Physics
Teaching and their Teaching Practice**

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Abstract

In recent years, the educational world has witnessed an accelerated growth and a wide spreading of a vast number of professional learning communities (PLCs) from different types. Science teachers' PLCs are part of an ongoing worldwide effort to improve science education, in order to fulfill the growing needs for preparing students and teachers to cope with the standards-based science education, the multicultural globalization and the knowledge era (Coreland & Hertz-Lazarovich, 2006).

In many cases, science teachers and among them physics teachers, work alone in the sense of not having many colleagues of their content field – if at all - in the near school environment. This isolation emphasizes the important role of national PLCs for science teachers, which aim to address the teachers' professional difficulties, develop their content knowledge and pedagogical abilities, and to build for them a network of supportive colleagues (Bell & Gilbert, 1994; Khanom, Daungkaew, Ngudgratoke, & Numun, 2017; Loucks-Horsley, Stiles, Mundry, & Hewson, 2009).

The purpose of the current research was to investigate a national PLC of high school physics teachers, in terms of their perceptions about physics teaching and their teaching practice, and to examine the data transfer and collegial interactions within the community.

From this purpose we derived the following three research questions: (a) what characterizes teachers who participate in a PLC, in terms of science teaching perceptions? What characterizes the difference, if any, between novice and experienced teachers? (b) In what ways, if any, has the membership in the PLC contributed to the teachers' practice, from the teachers' perspective? What characterizes the differences,

if any, between new participants and senior ones? (c) What characterizes teachers who participate in a PLC in terms of collegial professional interactions?

The PLC of this study is a long-term in-service professional development program for physics teachers. In this PLC, the teachers meet about once a month during the school year and a few times during summer school vacation, to discuss practical curricular issues, to share teaching ideas, to visit different scientific sites, and to enrich their subject-matter knowledge as well as their pedagogical content knowledge.

The PLC was established at the end of 2014, and the research was conducted in 2018, the fourth year of its activity. During the research year, the physics teachers PLC consisted of 25 teachers, whose number of membership years in the PLC distribute between 1-4 years. The members' teaching experience varied between novice teachers in their first years of physics teaching, more experienced teachers with several years of physics teaching experience, and very experienced teachers - some with over 20 years of physics teaching behind them.

The research methodology was mixed methods and included both qualitative and quantitative tools. In the study we utilized three research tools: semi-structured interviews with seven PLC members, class observations over two of the interviewees, an observation over one of the PLC activities, and a questionnaire that was filled out by 20 PLC members. In the interviews, the teachers were asked directly and indirectly about their teaching goals, perceptions, practice and collegial interactions, to answer all three research questions. The interviews' validation process was done by conversations regarding one interview, and a discussion how to relate the excerpts to the themes and categories. Internal reliability reached consensus of over 90%. The purpose of the class observations, which was based on the Reformed Teaching Observation Protocol offered

by Piburn and Sawada (2000) and was conducted under the supervision of an experienced researcher, was to characterize the teaching practice of a new participant and an experienced participant in our PLC, to answer the second research question, and to support the outcome from the interviews. The purpose of the PLC activity observation was to support the categories that appeared in the interviews, and was conducted under the supervision of an experienced researcher. In the questionnaire, the teachers were asked to mention different persons whom they had turned to during the previous year regarding their physics teaching, how often they had turned to them and about what subjects. The purpose of the questionnaire was to learn about the data transfer and the collegial interactions between the members of the PLC, to answer the third research question. The questionnaire used the validity analysis and overall design developed by Pitts and Spillane (2009). The questionnaire validation was done by three researchers, and the statistical tests were done under the supervision of an expert researcher in this discipline.

It was found from the interviews analysis that the teachers split to two very distinguished groups, regarding their teaching perceptions. The first group of five teachers, two very experienced, two experienced and one novice, represent a wide-scale approach, looking to develop their students' creativity and thinking skills, and the second group is of two teachers (a very experienced teacher and a novice teacher) who expressed a traditional approach to physics teaching. No significant difference was found between novice and experienced teachers.

It can be learned as well from the interviews analysis that the PLC had a significant contribution to the teacher's practice. The interviewees mentioned the PLC's contribution to technical aspects such as laboratories and experiments and to PCK. It

was also found that the PLC had a positive contribution to the teachers' knowledge assessment and curriculum issues.

Regarding the third research question, it was found that the PLC enhanced the collegial interactions and data transfer among its members. First, the questionnaire analysis indicated that the PLC senior members interacted within the community more than new members. In addition, the interactions within the PLC occurred on a higher frequency than the interactions outside the PLC. Another important finding is the reason the teachers mentioned for turning to that person - "because he is happy to help", which appeared significantly more at interactions within the community than outside, which indicates the supportive atmosphere of the PLC meetings and its importance. Another important finding was the distinction between informal and formal data sharing. A PLC which its members collaborate with one another for a long time puts the members in a great and convenient position for informal data transfer. Yet, it does not promise that the meetings' schedule will include time dedicated formally for data and ideas sharing.

It was found as well that the leader's character has a critical role in the PLC dynamics. It is therefore extremely important to find the right person for this role, someone who can have good interpersonal relations and be updated with the renewing teaching methods as well.

The research has theoretical and practical contributions. It emphasizes the significant contribution of PLCs with strong ties, to the diffusion of innovations and the data transfer among the members. Long term PLCs can have a meaningful influence on teachers' practice and support the teachers with technical issues.