

## A TEACHER DEVELOPMENT PROGRAM IN STATISTICS WITHIN A COMMUNITY OF PRACTICE

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*Very often, teachers' development programs unconsciously promote the dichotomy between theory and practice. Repeatedly, teachers are invited to programs where they are listeners instead of doers. In those programs, the teacher is conceived as a reproducer instead of a producer of knowledge. A teacher development program in statistics inspired by the social practice theory is an attempt to close the gap that teachers face every day trying to put together theory and practice. In this paper, I discuss the lessons learned from a teachers' professional development program in statistics following the principles of a community of practice. I discuss the strengths, the weaknesses of the program and the implications for teacher education.*

### INTRODUCTION

For so long, teachers' professional development programs have privileged the principles of the technical rationality inherited from positivism (Schön, 1992) where a strong emphasis is put in the theoretical knowledge and it is assumed that the practical knowledge is a natural consequence. Assuming the technical rationality, the teacher learns by imitating the techniques from those more experienced and following their instructions and advice. This format seems to be attractive to policy makers because it looks like an easy way to involve a large number of teachers in professional development programs. However, this format ignores the cumulative experience that the teacher has developed during the years, hides the teacher's voice, and looks at the teacher as a reproducer. In addition, this perspective of teachers' professional development is based on rigid principles that envisions an immutable society and ignores the natural development of knowledge. The literature has shown that this type of program falls short in making the links between theory and practice, science and common sense, academy and everyday life (Alarcão, 1996; Bjuland & Jaworski, 2009; Lopes, 2008; Schön, 1992).

We intend to overcome all these problems with an innovative teachers' development program in statistics inspired by the social practice theory in which the teacher is part of a community of practice as described by Wenger (1998). As members of a community, the teachers share a common practice and learn how to do it better as they interact. Communities of practice are "groups of people who share a concern, a set of problems, or a passion for a topic, and who deepen their knowledge and expertise in this area by interacting on a regular basis" (Wenger, McDermott, & Snyder, 2002, p. 4). In a community of practice, teachers participate in joint activities that allow them to learn and share their experience with others.

The professional development program we will refer to in this manuscript started with ten in-service mathematics teachers who were responsible for teaching statistics at the public schools in the city of Medellín, Colombia. They were part of a mathematics teachers' group sponsored by the Secretary of Education of the city and they had the tradition of regular meetings to discuss aspects related to mathematics teaching. Nonetheless, they have never carried out research by themselves. All the teachers held professional degrees in mathematics education and some of them were pursuing master degrees in sciences. During the program, the teachers got together on weekly meetings for a whole semester to share their experiences, to comment on others' work, to suggest ways of doing things and to design lessons. Two researchers were also part of the community and during the professional development program, they operated like leaders and avoided any hierarchical relationship. Usually, pieces of statistics lessons, lesson materials or statistical activities that the teachers brought to the meetings were the inputs to start the discussions and arrange future agendas in the program. We gathered information from different sources (all of them in Spanish) for subsequent analysis: video recordings of the weekly meetings, teachers' journals (to keep a memory of the meetings and some teachers' reflections), teachers' autobiographies, and follow-up teachers' interviews. In the rest of the manuscript, we discuss the lessons learned from

this teachers' professional development program in terms of the strengths, the weaknesses and the implications for teacher education.

## STRENGTHS

A teachers' professional development program following the principles of a community of practice has several strengths. Some of them are related to the opportunity to link theory and practice, the value of collaboration among teachers and among teachers and researchers, the significance of promoting reflective thinking, the potential for transforming teachers' image and the importance of teachers' authentic interest in the program. In the following paragraphs, we describe each of these strengths.

Linking theory to practice is a discussion that has been in the heart of the academic community for some years (Even & Ball, 2009; Skott, 2008). The base of this discussion is that the theoretical knowledge produced by researchers is disconnected from the practical knowledge produced by the teachers through their experience. In addition, there exists a dichotomy where the theoretical knowledge is delivered in the university while practical knowledge is delivered in the classrooms (Anderson & Freebody, 2012). The structure of many teachers' development programs does not allow the connections between theory and practice since they commonly promote teachers' reproduction of knowledge (information) or pre-established practices. Following a technical rationality point of view, concrete problems in the practice can be solved with applied science. In other words, for a specific problem, it would be enough to learn the appropriate technique. This, however, is not that simple; theory cannot always unmistakably explain what happens in the real classroom.

In the professional development program we carried out, we looked for making clear the connection between theory and practice. In doing so, the participant teachers brought specific episodes from their classroom to start the discussions. For example, one of the teachers prepared a class about the multiplicative principle. She video-recorded her own class and brought some fragments of the class, some teaching materials and some students' work to the meetings for feedback from her colleagues. The discussion took place, some comments were intended to improve the instruction and the teaching materials design, but others were thought-provoking reflections. Afterwards, the teachers wrote down in their journals what they learned and some reflections from the discussions. The teacher who brought the class went back and redesigned the lesson and the teaching materials, and in a subsequent meeting brought her new reflections. We consider that this cycle where the teachers bring, reflect, adjust and bring again is an appropriate setting for linking theory and practice. Consequently, the discussions did not progress based on an ideal classroom but based on real situations within real classrooms. Thus, the practice could serve as a basis for theorizing and theory could inform the practice (Alarcão, 1996; Skott, 2008). According to social practice theory, learning is situated. Promoting teachers' learning by studying their own realities and problems could help to close the gap between theory and practice since learning takes place situated within their own realities. In addition, giving the teachers the space to bring their own realities to the professional development programs put the participant teachers in a very important position. They do not come to the program exclusively to listen; they are listened to because they are the experts in their practice and their voice is stimulating. For example, one of the participant teachers expressed, "I value the meetings and discussions. [...] It is vital that we do not only focus on the activities but also we analyze them, their goals, their ways of presenting them, their performance standards and everything else related." (Daniel's journal, May 14, 2013).

Teaching is an activity that is done in isolation (Horn, 2012). Teachers on their own are required to identify the problems in their practice and figure out ways to solve them. In Colombian educational system, there are very few opportunities for teachers to work in collaboration with other colleagues. In most of our programs, teachers follow this route: attend, learn and then apply at the schools what they learned. One of the strengths of the program we completed is the possibility of collaboration among teachers. The design of this program allowed teachers to share different experiences, activities and materials in the meetings and get useful feedback from their colleagues. Collaboration allows teachers to revisit classroom event, teaching material and open up opportunities for professional learning (Bjulan & Jaworski, 2009). Participant teachers valued collaboration in the community as a landmark. For example, one of the teachers expressed in

relation to the community, “it has allowed me an active and reflective participation. Listening to colleagues’ comments, experiences and points of view has been a very important input for the development of my classes” (Nancy’s journal, May 10, 2013). Another teacher highlighted the importance of others’ comments, “The reflections and inputs of each member have been helpful in establishing standards for teaching statistics” (Wilson’s journal, May 15, 2013).

Collaboration also took place between teachers and researchers. In this program, there were several products created in partnership with the statistics teachers. We wrote a paper in collaboration with the teachers for a national conference (see Castaño, González, & Zapata-Cardona, 2013) and we are in the process of publishing a compilation of statistics lessons that the teachers designed as part of their participation in the program. Working in collaboration is a highly positive aspect since it is an attempt to blurry the boundaries between teachers and researchers (Makar & O’Brien, 2013). Furthermore, working in collaboration with schoolteachers put them in a very committed role.

Another aspect to highlight from this professional development program is the opportunity to promote teachers’ reflective thinking. According to Dewey (cited in Alarcão, 1996) reflective thinking consist of mentally examining a matter and giving it serious consideration. The function of the reflective thinking is to transform a situation characterized by darkness, doubt, conflict, or distortion into a clear, coherent, organized and harmonious situation. The reflection in action constitute an essential element in improving the teaching practice (Anderson & Freebody, 2012) and teachers are assumed as protagonists in the educational process. A program designed as a community of practice allows the promotion of teachers’ reflective thinking as it was expressed in Zaida’s talk after observing a video of herself teaching a combinatory class, “When I saw myself in that class [...] I wondered why I did that, why I did talk like that. I have not noticed that difficulty” (Zaida’s reflection, May 15 session, 2013). Teachers also recognized the value of reflection, “I think reflection is one of the most powerful tools for transforming teaching practice” (Germán’s journal, April 24, 2013).

There are different models of professional development programs for teachers. Each of these models leads to different images of teachers. For example, the programs that follow the technical rationality criticized by Schön (1992) have a way to look at teachers. In such a particular perspective, the teachers implement, translate, use, adapt and put into practice the formal knowledge. The teacher is a consumer of knowledge and a research receptor but s/he is not a producer of knowledge (Cochran-Smith & Lytle, 1999). One of the strengths of the teachers’ professional development program we undertook is that it turned that persistent image of the teachers into a more proactive image. Teachers learn by challenging their own beliefs, identifying real problems from their practice, studying their own students and classes, and building their own curriculums. The teacher is a transformative intellectual.

In Colombia, there is a well-known tradition that teachers participating in development programs get something in exchange. Sometimes, they get credits for future promotion, credits for graduate school (in case they enroll in graduate programs in the near future) or just a reduction on their teaching load. In the program we offered, none of these incentives were available for the teachers. We invited the teachers to join the program without offering them anything in return but the joy of learning within a community and the option to participate in a different experience. We consider teachers’ enrollment in the program a strength that reflects teachers’ authentic interest. They enrolled in the program because they were open and they saw in it an opportunity to learn something from others. We valued this aspect and so did the teachers. Teachers refer to the program as a setting where they felt welcome and confident; they felt part of a professional team where their contributions were valued. One of the teachers referred to the community as “a place for appropriate learning because here we show our fears and strengths and learn a lot as a team” (Zaida’s interview, August 12, 2013).

## WEAKNESSES

A professional development program as a community of practice has some specific characteristics. Teachers act as members of a community that shares a concern or a passion for a topic. Everybody in the community shares something and takes something back. According to Wenger (1998), an essential ingredient and a source of cohesion of a community of practice is the

participants' mutual commitment to take forward the joint venture. Belonging to a community does not only mean to join a group of people that share a common task. The mutual commitment refers to the generation of relationships of joint participation about important matters regarding a common goal.

We created relationships as a function of the personal traits and the venture undertaken. This does not mean that there was always perfect harmony. As in any situation of personal commitment there were moments of tension and disagreement. The mutual commitment does not suppose homogeneity of the participants or of their functions. Each member of the community finds their own place, assumes certain tasks, generates certain situations, and helps to solve problems. Although all the participants contributed with something to the community, in this professional development program it was hard for us to understand the different dimensions of the mutual commitment. We anticipated certain consistency in participants' contributions because we were not properly using the lenses of our theoretical framework. Those expectations generated in us some frustrations in terms of teachers' attendance and teachers' responsibilities that we describe below.

We had difficulties understanding participants' absences to the program. Teachers' attendance was not always regular. There was only one teacher coming to every single meeting, all the other teachers had some absences. At the beginning, we tried to see teachers' attendance as a rough indicator of teachers' commitment and this aspect made us question whether this setting really was a community of practice. To illustrate this concern, there was a session where two teachers were in charge of presenting their experience teaching a statistics class in the school. The date of the session came and these two teachers did not attend the meeting. This fact made us question their commitment. However, in the following meeting they came, presented their excuses to the team, and took over the session.

In our desire to guarantee participants' attendance and commitment, we developed several strategies. We emailed teachers during the week and we called them to let them know how important their contribution was to the group. In addition, when presenting the program to the teachers, we gave a twenty-minute presentation where we talked about the social practice theory and the characteristics of the communities of practice focusing on the mutual commitment. The purpose of that presentation was to explain the program and to make clear the expectations we had for those who decide to participate. Our frustration took place because we were expecting uniformity in teachers' participation; but based on the theory, each participant is unique and contributes according to his/her history (Wenger, 1998).

Part of the participants' responsibilities in the development program was to have a weekly journal where they would write down some remarkable experiences from the meetings and some of their reflections. At the beginning of each session, we usually asked a volunteer to read the journal from the previous meeting so that we recalled what we did and made comments on teachers' reflections. We gave teachers a notebook for this purpose. However, one of the teachers created a web page where he made his journal accessible to everybody. We saw his initiative as an excellent way to keep posted those who missed a meeting; we recommended the teachers to check that web page in case they needed to be absent so that they could be informed about the progress of the program. Unfortunately, the teachers who had to miss a meeting did not even check the web page before coming to the following meeting. They usually came to the next meeting and discovered the progress in the previous session by listening to other teachers' journals. This aspect as well as teachers' attendance generated some disappointment in us because we were expecting a certain way of doing things. However, as we studied the theory, we understood that the participants were finding their way in the community (Wenger, 1998). Teachers did not see any need to check the web page because at the beginning of each meeting we always revised a journal. Teachers did not spend time in something they would do again at the beginning of the meetings. It took a while for us to understand that.

The principle of mutual commitment is also related to accomplishing the tasks proposed in the group. There were, however, several times where participants were given responsibilities as small as reading a paper, checking out an activity or presenting some experience, and some of them came to the next meeting without carrying out their tasks. At the beginning, we saw a flaw when teachers did not accomplish their tasks. Nevertheless, as we progressed through the theory, we

understood that members' participation in a community of practice is not uniform. Some members assume a legitimate participation but others' participation is peripheral (Wenger, 1998). The meetings showed very interesting contrasts in terms of teachers' participation. There were participants that did every suggested reading; they were the ones proposing the sharper and deeper comments during the discussions. Those who did not do the readings participated timidly in the discussions but learned from others' comments. Those in a peripheral position also participated.

Other weaknesses we saw in the program are related to the leadership in the community and the flexibility of the agendas. Mutual commitment could mean that every member of the community of practice takes the lead from time to time. In other words, the leadership should not be concentrated in only one leader. We feel that this professional development program had that flaw. Although, all the members contributed to the community, the agendas for the meetings depended on two leaders. This aspect, according to the theory, makes the community vulnerable since it has the tendency to silence other voices and reduce the diversity in the community (Wenger, McDermott, & Snyder, 2002). One of the lessons learned from this program is not to depend on the coordination of a single leader or on a single group. The leadership in a community of practice should be spread out among the participants.

There were not fixed agendas in the program. Each session progressed according to teachers needs and concerns during previous sessions. If teachers showed special interest in a specific topic, we tried to address it. For example, after one teacher shared her doubt class learning the multiplicative principle, participants brought activities, reflections and comments related to the topic. This characteristic of the program could be considered an advantage, but at the same time could be considered a tension and a potential issue since teachers did not know what to expect. Some teachers look at this as a lack of precision in the program.

#### IMPLICATIONS FOR TEACHER EDUCATION

Teachers' professional development programs have a strong tradition in the technical rationality that puts too much weight in the teacher's knowledge (formal knowledge). There is a small but growing trend that puts the emphasis of teacher preparation on teachers' practice (Bjuland & Jaworski, 2009; Cochran-Smith & Power, 2010; Ponte, 2008). The program we present here is an attempt to overcome that old paradigm that promotes the dichotomy between theory and practice. We feel that although teachers' development programs following the principles of communities of practice have some limitations, the strengths are worthy to be considered in teacher education.

We described the potential that a teachers' professional development program inspired by the social practice theory has in linking theory to practice, promoting collaboration among teachers and transforming teachers' image. The design of this program, however, is not a conventional one. It requires lots of preparation and most of the sessions are built based on emerging concerns. It is clear that this is not a simple condition and might not work as massive program in teacher education.

Teachers' professional development programs following the principles of communities of practice have their own pace. Teacher educators and researchers cannot put any pressure or speed in the programs as they progress according to their own agendas. Furthermore, the members need to feel part of a community and that affiliation takes time to develop.

The realities of our classrooms cannot be dealt with using predetermined answers (Lopes, 2008). Therefore, it is necessary to overcome the idea in which it is believed that a specific technique can solve many practical problems in the classroom. This assumption implies a different conception of the teacher. In the alternative view we support, the teacher is a professional who can leave his practical role to become a researcher of his own practice (Ponte, 2008). The teacher is a professional with ability to perform a theoretical, immediate, and founded reflection based on the problems that arise from their professional work. In this way, we are advocating for a critical perspective of professional development in which statistics teachers can generate their professional knowledge (as described by Ponte, 2008) to improve their practice throughout life.

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