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► **To cite this version:**

Francisco Rojas, Daniela Rojas, Roberto Araneda, Helena Montenegro, Salomé Martínez. Mathematics teacher educators' conceptions of professional learning. Thirteenth Congress of the European Society for Research in Mathematics Education (CERME13), Alfréd Rényi Institute of Mathematics; Eötvös Loránd University of Budapest, Jul 2023, Budapest, Hungary. hal-04420730

HAL Id: hal-04420730

<https://hal.science/hal-04420730>

Submitted on 26 Jan 2024

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Mathematics teacher educators' conceptions of professional learning

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The quality of future teachers' educational experiences shapes the quality of their learning outcomes. The teacher educator plays a key role here. Although there have been various teacher improvement initiatives in Chile, not all teacher educators were considered. One fundamental way of addressing this gap is working with communities of practice as spaces for reflection and inquiry about one's own practice while favouring collaborative work. Considering those mentioned above, this study describes the initial conceptions of a group of 31 mathematics teacher educators regarding professional learning. They discuss its meanings, its purposes, and the conditions for its development. The dominant conception suggests that teachers' professional learning should be situated in a way that considers the training context and is collaborative with a focus on reciprocity. There should also be coherency between their own practices and what the future teachers are expected to learn.

Keywords: Professional learning, mathematics teacher educators, professional development.

Introduction

The role of the teacher educator in preparing future generations of teachers is crucial in facing the various challenges they will encounter in the school system (Hadar & Brody, 2017). In this context, recent works have reported that supporting the professional development of teacher educators is key for supporting future teachers learning (MacPhail et al., 2019; Van der Klink et al., 2017). These studies have identified several important issues to consider in this regard. First, reports show that mathematics teacher educators usually launch their teaching careers without formal preparation, receiving little or no support at the beginning or during their professional careers (Montenegro, 2016; OEI, 2022). Second, it has been shown that teacher educators with varied backgrounds and professional experiences coexist in the same teacher education programs (Hinostroza, 2019; Montenegro, 2016), which is a challenge when designing spaces for professional development (MacPhail et al., 2019; Van der Klink et al., 2017). It has also been observed that when hired, academics are expected to develop their professional identity as teacher educator (Murray et al., 2011), but their role and identity as a researcher is not encouraged, let alone the need to investigate their own teaching practices (Hinostroza, 2019; MacPhail et al., 2019).

Relevant professional development seems essential to address the difficulties that teacher educators face in their career. On the other hand, the expectations, and conceptions that these professionals have about professional learning are key to their long-term involvement in this type of activities. Understanding these conceptions is key to designing and sustaining such initiatives. Thus, in this study we are interested in the following question: What counts as professional learning among Chilean mathematics teacher educators? To investigate this, we collected focus group discussions with Chilean mathematics teacher educators in the initial stages of a professional development and

learning programme. A central part of this programme will be the work of teacher educators in communities of practice, and the analysis of their conceptions will be key to counteract their reflection while participating in them. In addition, we hope to observe whether conceptions are being enriched or refined, and to see how professional learning is being generated.

This study is part of a recent R+D project in Chile larger research project that encompasses this study focuses aims to building a system of ongoing, systematic support for teacher educators who teach mathematics in initial teacher education programs for both primary and secondary education (www.redfid.cl).

Professional learning development

The literature highlights the importance of developing professional learning among teacher educators (Van der Klink et al., 2017). Professional learning is based on the commitment to change, and it occurs with and/or by teacher educators, which entails applying their expert judgment so that said change is best implemented in their context and practice (Loughran, 2010). This international consensus has led to the development of different professional learning programmes. One approach to such programmes relates to those that are self-guided, in which teacher educators engage in individual or group research, taking responsibility for their own learning and professional development (Hadar & Brody, 2017). From this point of view, professional development takes place in supportive and collaborative learning spaces to articulate educational policies and practices (Kennedy, 2005). This model emphasises the study and development of situated practices as a strategy for transforming teaching. It is essential to pay attention to the type of knowledge and context in which learning occurs and to all those collaborating to implement this model.

One way to strengthen professional learning is to create communities of practice that can serve as an appealing professional learning model for teacher educators. These communities are made up of professionals who share concerns and problems to augment their knowledge and experience while focusing on collaboration and collaborative learning (Avidov-Ungar et al., 2021). This model of professional learning resonates with what has been reported by studies of teacher educators, who indicate that the professional learning experiences they consider most significant are those that take place within a community, support network, group, and/or peer association (MacPhail et al., 2019; Suppa et al., 2020; Van der Klink et al., 2017). In such contexts, professional learning would be understood as the product of reflection and inquiry into one's own practice. This inquiry corresponds to the ongoing effort of problematizing teaching experiences and being open to understanding what is happening, which can be carried out through more formal processes of innovation and research around the practice.

Methods

Participants were 31 mathematics teacher educators at 14 Chilean universities that participated in the First National Seminar of Mathematics Teacher Educators held in mid-December 2022. This seminar was one of the activities included in the project described above. The mathematics teacher educators were primarily women (only 11 men), with institutional affiliation to regional universities (only 10 are linked to universities in Santiago, Chile), and teach in primary and/or secondary teacher education

programs. They mainly work in education and/or humanities departments or faculties (only six works in science or mathematics faculties).

Data were collected from five focus groups carried out simultaneously and directed by a researcher from the project. The five researchers met to prepare the focus group implementation methodology and a script was used. Each group was composed of five to seven teacher educators, previously assigned, taking care that they were from different universities. The objective of the focus group was to discover their perceptions regarding crucial topics about professional learning that would later be useful for comparing their experiences across their participation in the support system. Specifically, the data recollected refers to what the various mathematics teacher educators had to say about how they view professional learning and what they consider to be key topics and opportunities for strengthening mathematics teacher educators. They answered the following questions:

- a. What is professional learning, and what should it be like for mathematics teacher educators?
- b. What are essential issues for strengthening the professional learning of mathematics teacher educators?
- c. What types of opportunities are crucial to strengthening the professional learning of mathematics teacher educators?

A thematic analysis was done (Braun & Clarke, 2006) to identify the specific conceptions of the mathematics teacher educators regarding what they understood by professional learning. During the data analysis process, the first three authors reviewed each focus group separately; they held three meetings to cross-check the coding of the responses and the categorizations, improving the set of codes as required. The reliability of the data analysis was thus enhanced through this auditing process (Cohen et al., 2000).

Results

We identify three key elements underpinning the conceptions of professional learning among mathematics teacher educators: what they understand as professional learning; the reasons for engaging in it; and the context that favours it. These elements are described below along with quotes selected to faithfully convey the meaning intended in the evidence.

Conceptions of professional learning

The mathematics teacher educators' conceptions of professional learning refer mainly to what specialized knowledge and professional skills or competencies they should reach, further characterizing it as situated and dynamic. In general terms, mathematics teacher educators conceive of professional learning as specialized knowledge about their work. They point out that it is varied because it involves diverse aspects but is specific to "teaching mathematics." The mathematics teacher educators agree that this knowledge goes beyond mathematics as a discipline. They describe it as broad and point out that it involves additional knowledge that they consider essential to their teaching efforts, such as pedagogical, didactic, and curricular. Some even name affective aspects, as observed in the following quotation:

FG2_MTE1: Professional learning is not only related to the discipline. It has to do with the competencies, skills, characteristics, and everything my work involves, which is also affective, disciplinary, cognitive ... it is wide-ranging.

Regarding didactic knowledge, they view it as a structural component of the discipline and underscore its importance in the execution of teaching-learning processes. For example, a mathematics teacher educator note:

FG5_MTE2: Didactics is an aspect of the discipline, at least from the theoretical approach we have here, and vice versa, too. I think of mathematics as important, and mathematical knowledge per se is important. It is not about letting them fail to demonstrate what they have learned. It is about ensuring they understand the knowledge.

On the other hand, mathematics teacher educators also conceive of professional learning as a set of skills and competencies related to their teaching work and their ability to stimulate learning processes so that future teachers can teach mathematics effectively, as seen in the following excerpt:

FG3_MTE5: I believe that these are also professional competencies of the teacher. [...] which are the competencies that we should have. Because it is very different to teach when thinking about standards while also thinking about how future teachers will have to teach in other contexts.

Additionally, they conceive professional learning as situated and dynamic. They point out that it is situated because it is specific to teacher training and is related to the school context:

FG4_MTE2: Teachers' professional learning is individual. It is recognized as situated learning and has to do with school contexts.

They point out that it is dynamic because it varies over time and adapts to the educational system conditions and requirements in which future teachers must perform:

FG3_MTE4: I kept thinking about dynamism. Thinking about how our profession is always evolving, always changing, needs keep arising [...] we always come across things that are changing, that are being modernized.

In short, mathematics teacher educators' conceptions of professional learning not only has to do with a piece of specialized knowledge and refers to professional skills and competencies specific to their work. This specificity that characterizes their conception of professional learning is also notable when they point out that it is situated and dynamic.

Aims of professional learning

Some of the primary purposes of professional learning mentioned by mathematics teacher educators include reinforcing their training, changing their classroom practices and adapting to the educational context.

For mathematics teacher educators, professional learning strengthens their instruction. It can reinforce different types of knowledge they have gained from their initial and/or continuous training of various types, such as disciplinary or pedagogical knowledge. It can also help consolidate a range of skills as they learn about new methodologies for teaching mathematics. This positioning came through most notably in the different focus groups when the mathematics teacher educators state that:

FG1_MTE5: Professional learning must allow the educator to acquire different types of knowledge to teach the class.

Regarding the different types of knowledge, the mathematics teacher educators mention that:

FG3_MTE: ... not only disciplinary or pedagogical knowledge, but also an awareness of how to teach the different skills that can be shared through teaching...

The teacher educators emphasize that strengthening their own education based on different types of knowledge should lead to changes in their classroom practices, which accounts for the transition between what is gleaned through professional learning and how this impacts their work as mathematics teacher educators. For instance, a participant highlights that:

FG3_MTE1: ...This learning involves not only knowledge but also the skills needed to adapt this knowledge and all the contents, if we want to put it that way, to each individual context. However, in addition, to be able to model this so that our students can also apply them while analysing their own experiences to adapt to different contexts.

Likewise, for mathematics teacher educators strengthening the different types of knowledge through professional learning enables innovation:

FG5_MTE2: Encouraging innovation in the classroom in such a way that the courses in the training program take novel aspects into consideration that are aligned with new didactic proposals in mathematics.

Lastly, when mathematics teacher educators refer to the fact that one of the purposes of professional learning has to do with adapting to a range of training contexts, they see it as important since it depends on the type of student, they are training, the institutional context or hallmark and the type of initial training program it pertains to (primary or secondary teacher education in mathematics). This perspective is notable when the mathematics teacher educators point out the relevance of future educational context of prospective teacher:

FG3_MTE4: The type of teacher I want to train is in line with the institutional context.

FG3_MTE1: To provide a toolkit since we are the educators of future teachers so that they can also adapt to and function in various educational contexts in the future.

Conditions for the development of professional learning

The conditions that mathematics teacher educators establish to develop their professional learning are mainly related to the continuous and situated nature of the process, with the collaboration and reciprocity among participants and with the consistency of their actions/behaviour towards the students.

Across the board, the situated nature of professional learning seems to be key to its development, as stated in the following extract:

FG5_MTE4: Professional learning; I have learned it in practice through students I have been educating, and there is also an interest in ongoing learning.

In fact, their prior experiences are called into question while reflecting on their capabilities and knowledge:

FG5_MTE3: When I entered the university setting, I had to reformulate many of the teaching strategies I had been using. To do so, I had to understand my own abilities and qualities, so I could connect them to my disciplinary and professional knowledge.

In this way, it is recognized that professional learning depends on the context, both for university teachers vis-à-vis their students and the educational experiences at school, together with a reflection on their knowledge and capabilities.

Another issue gaining consensus among mathematics teacher educators is the need for collaboration as a prerequisite for developing professional learning. In fact, collaborative experiences lead to satisfaction, despite the high workload involved:

FG2_MTE5: I feel that after having sat down with my four colleagues once a week to discuss mathematics and how mathematics is taught, [...] to have come together as a team to work on mathematics, to think about mathematics, for the others, meaning our undergraduate students in primary education, it was very significant.

One issue that stands out for the mathematics teacher educators when discussing collaboration is the need for reciprocity among the collaborators:

FG3_MTE3: When you collaborate with another, learning and the chance to improve become reciprocal. I think those are the best opportunities because you don't feel that you are only giving or only taking.

Thus, it seems that a genuine collaboration in which educators truly feel they can learn from each other while contributing something to that person would be required to develop deep and effective professional learning.

Lastly, one significant aspect that mathematics teacher educators bring up in terms of professional learning when looking at their own practices is the gap that often exists between practice and discourse. From two different focus groups, one educator points out the concern that this leads to, and another gives a concrete example in this regard:

FG2_MTE4: That disconnect between what is said and what is done I find to be quite difficult.
FG3_MTE1: For example, schools often also ask us to work in project format, but at the university [...], we do not do any interdisciplinary or transdisciplinary work.

Here it would appear that the reflection on how the practice is a teaching model for student teachers becomes a precondition for acquiring a more thorough professional education regarding the task of teaching others how to teach.

Conclusions

This research shows relevant findings regarding mathematics teacher educators' conceptions of professional learning. One of the issues that participants consider as part of professional learning is the specific knowledge they require for the task of teaching, which is varied, situated, and dynamic, involving pedagogical, didactic, curricular, and affective aspects. The teacher educators state that this specific knowledge contains a set of skills and particular professional competencies for the education of mathematics teachers. Regarding the situated character that mathematics teacher educators attribute to professional learning, they relate it to the conditions under which knowledge is acquired. They point out that the type of information involved in this learning must be relevant and appropriate to their professional work. To successfully learn, the context and practice itself must be understood in order to adapt to the different training environments. This mathematics teacher educators' conceptions of professional learning are aligned with the second approach Kennedy (2005) drew up on the professional development of educators, which describes it as a space of support and

collaborative learning to articulate policies and practices. Implementation requires paying attention to both the type of knowledge and context and the people collaborating in the process.

Additionally, for mathematics teacher educators, professional learning necessitates collaboration between peers and requires reciprocity among the collaborators, especially regarding the analysis and reflection around teaching practices. This finding is in line with other studies with teacher educators who point out that the learning experiences they consider most significant are those developed in a community, support, group, or peer-to-peer networks (Suppa et al., 2020; Van der Klink et al., 2017). Mathematics teacher educators generally agree that reflection around the practice is crucial to furthering professional learning since it promotes the strengthening of knowledge and teaching skills. They also conceive of it as a teaching model for future teachers. For mathematics teacher educators, such coherence between their own practices and what future teachers are expected to learn enhances their teaching performance in a way that shares a vision of teaching and learning according to current educational guidelines.

The conception of situated, collaborative, and formative professional learning that this group of mathematics teacher educators expresses will be key to working in the communities of practice in which they will participate. This finding will be a starting point to analyse the mathematics teacher educators' conceptions of professional learning in the following phases of the project and to compare them against the results obtained in this work. While it is possible to study how their conceptions vary when participating in communities of practice, one must bear in mind that other experiences may interfere with their learning and professional development, meaning that subsequent studies must respond to the needs arising from the varied contexts of the participating mathematics teacher educators.

Acknowledgment

This study was made possible thanks to the FONDEF project ID21I10067 led by the Mathematics Education Lab of the Center for Mathematical Modeling (CMM) at the University of Chile (basal fund FB210005), both funded by the National Agency for Research and Development ANID-Chile, and the UNESCO Chair Preparing Teachers to Teach Mathematics in the 21st Century. Francisco Rojas is a *María Zambrano* Postdoctoral Researcher at the *Departament de Didàctica de la Matemàtica i les Ciències Experimentals - UAB*, under the program Grants for the Requalification of the Spanish University System RD289/2021 [*Ayudas para la Recualificación del Sistema Universitario Español*], funded by Ministry of Universities, Spain and the European Union (Next GenerationEU).

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