Unpacking Critical Friendship between Mathematics Teacher Educators: an opportunity for professional learning

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While the community highly values critical friendship experiences between teacher educators, there is little evidence regarding what happens within such experiences. In this study, we report a Self-Study developed by two mathematics teacher educators (MTE), focusing on their critical friendship sessions on preparing and implementing a sequence of classes by one of them. Data collection occurred by recording three critical friendship meetings conducted at the end of implementing a sequence of classes related to quadratic equations. Results discuss different types of questions focused on understanding MTE’s pedagogical reasoning and teaching practice. On the other hand, the analysis of the corpus allowed characterizing their level of depth (descriptive or analytical) and the type of content (professional or didactic-mathematical). These findings enable unpacking the critical friendship relationship and invite to explore in-depth the interactions between MTE and critical friend and the possible impact on both professional learnings.

Keywords: Mathematics teacher educator, critical friendship, reflective practice, pedagogical reasoning, professional development.

Introduction

Several studies, especially those referring to the practice of teaching (Beswick & Goos, 2018; Castro Superfine & Li, 2014), have reported that mathematics teacher educators (MTE) have a crucial role in the development of complex learning in their prospective teachers. Through their teaching practices, MTEs offer prospective teachers opportunities to learn mathematics as their future students should learn that subject (Chapman, 2008). As a result, the quality and effectiveness of mathematics teacher education depend on mathematics teacher educators’ expertise (Goos & Beswick, 2021; Ping et al., 2018). However, studies about the development of mathematics teacher educators and the challenges they face in their work are scarce. Masingila & Olanoff (2021) highlight that most mathematics instructors in teacher education programs do not have professional support or training in becoming teacher educators. Although several studies have noted that studying one’s teaching practice is a powerful tool for teacher educators to reflect on and improve their practices (Schuck & Brandenburg, 2020), Liang et al. (2019) claim that MTEs have little opportunity to study and develop their teaching practices.

To contribute to this discussion, we present a part of a Self-Study to go deep into the reflection on the practice of a novel MTE promoted by a critical friend (Schuck & Russell 2005), a colleague experienced in mathematics teacher education. This kind of collaboration in self-study is crucial for
going beyond their initial background and expertise. In fact, this strategy supports the practice of reflecting on their own teaching as an inherent part of the work of mathematics teacher educators (Chapman, 2008). However, little is known about the practice of being a critical friend, exploring how to manage the questions, tensions, and dilemmas through appropriate support. To understand this collaborative process, we seek to answer the following research questions: what kind of questions does the critical friend promote to elicit the MTE's thinking? From the conversation with the critical friend, what characterizes the reflections of the MTE? This self-study is expected to unpack the reflection generated in a critical friendship between a novel and an experienced MTE and give new instances of reflective practices.

**Conceptual Framework**

In studies on the professional development of MTE, the notion of reflective practice as a means of linking theory and practice has been relevant (Goos & Beswick, 2021). In this way, different studies state that self-study allows MTEs to improve their teaching practices (Schuck et al., 2008; Schuck & Brandenburg, 2020). For example, Tzur (2001) researched his own professional path, tracing his experience as a mathematics learner, mathematics teacher, mathematics teacher educator, and mentor of fellow mathematics teacher educators, identifying crucial events and experiences that advanced his professional knowledge and practice. Schuck et al. (2008) point out that teacher educators can improve their teaching practices through reflective practice and learning conversations with critical friends. In the literature on self-study, critical friends can be from the same discipline area or different areas. They can be colleagues at different stages of their careers (Schuck & Russell 2005), and commonly reflection on practice involves collegial expert-novice partnerships (Goos & Beswick, 2021). On the other hand, an explicit goal of MTEs’ research of their practice should be self-understanding and professional development (Chapman, 2008). Therefore, we need to include in the research how the teacher educator-researchers reflected, inquiring in different kinds of questions reflective practices are developed in the interaction between MTE. To what extent can this practice become unpacking and sharing with other mathematics teacher educators to implement this process as a professional learning practice.

**Methods**

This paper reports a collaborative research project in two voices based on a critical friendship between Author 1 and Author 2 and is part of a broader self-study. Samaras (2010) states self-study as the critical examination of one’s actions to achieve a more conscious mode of professional activity. Hence, it is a self-focused and interactive approach that seeks meaning rather than solutions to a specific problem. In this research, Author 1 who takes the role of critical friend is an experienced university-based MTE. He teaches method courses in primary and secondary mathematics teacher education programs connecting permanently theory and practice in mathematics education, and investigates the role model practices held by mathematics teacher educators. Author 2 is a school-based novel mathematics teacher educator who teaches a method course (Mathematics Teaching and Learning) in a secondary mathematics teacher education program and works as a practicum supervisor of prospective
teachers. The double role of Author 2 makes him permanently connect his teaching as a MTE with his practice as a school-teacher.

Data collection occurred by recording three critical friendship meetings before and after implementing a sequence of classes related to quadratic equations and functions teaching. In weekly meetings, Author 1 and Author 2 engaged in critical dialogue around MTE’s teaching experience. During the first session, the focus was on establishing critical friendships and exploration of the issues which the MTE wanted to address in this self-study. During the second session, the MTE had to communicate the planning of classes that would be the object of analysis in the study and discuss the same with the critical friend. Finally, the third session addressed implementing the previously analyzed classes, delving more deeply into various topics.

The data analyzed were the transcripts from audio-recorded meetings. We conducted a thematic analysis (Braun & Clarke, 2006) to identify themes related to personal and professional tensions in Author 1’s experience of becoming a mathematics teacher educator and his teaching practice. For doing so, a constant comparative method (Corbin & Strauss, 2015) was used to code the data, starting with open coding iteratively. A second coding round was conducted to collapse codes into themes such as recurrent questions, recurrent reflections, and foci of reflection. A third coding round was completed using the refined codes to understand where those themes were expressed or addressed. Several cross-data triangulations were made across this coding scheme, with the collaboration of another researcher (Author 3) to validate codes, themes, and consistency (Cohen et al., 2000). Also, we discuss the main finding with the whole research team.

Results

Based on the analysis conducted, we were able to identify various types of questioning undertaken by the critical friend, and diverse types of answers and reflective practices used by the MTE.

Role of the critical friend: delving further into some assumptions

In general, we observe two major modes of asked questions during dialog and discussion. The first mode, referred to as questions asked to attempt to understand pedagogical reasoning, focuses on the MTE’s reasoning about the phenomenon under discussion, promoting explanations regarding adopted decisions. Instead, the second type of questions, identified as questions attempting to understand the MTE’s teaching practice, focuses on getting the teacher educator to establish relationships between his experience and decisions made that lie at the basis of his teaching practices, either in a higher education or primary or secondary school context, both at the present time as well as within other time frameworks.

We distinguished three types of questions that focused on pedagogical reasoning: Exploration questions, Discussion questions, and questions aimed at Deepening Insight. Exploration questions sought to open up topics of conversation meant to enable the MTE to begin his reflective practices dealing with said topics. For example, in the first work meeting, the critical friend makes the following
statement to get the teacher educator to clarify what he expects to get out of these collaborative work sessions.

**CF:** Then, the first issue is what it is you would expect to get out of a process of joint reflection such as this self-study. What is it you would expect based on what we have already read and gotten to know of this methodology regarding the meetings with the Critical Friend?

On the other hand, Discussion questions enabled the teacher educator to comment on his reasoning about making decisions, or on the topic under discussion. A clear example is a discussion about the content of classes. The critical friend questions the MTE about the reasons he must incorporate the concept of the didactic variable into his classes.

**CF:** And why is the didactic variable interesting?

**MTE:** Why is the didactic variable interesting!? [CF: Yes, why?] In other words, the didactic variable, just as a concept who cares whether it is called didactic variable or whatever it’s called.

**CF:** OK, but why does dedicating a full two-module class to this content seem interesting to you?

Finally, the last type of question was the one aimed at deepening insight, which attempted to get the MTE to reflect on his own explanations or reasoning regarding the phenomenon under discussion. For example, a broad debate about the teacher educator’s role as a model develops in the second session, and about what the latter thinks is being modeled in his classes. In this context, the critical friend engages more extensively in reflective practice and formulates questions that enable him/her to delve deeper into the MTE’s thinking.

**CF:** [...] when you are teaching the class on equations or on some other mathematical subject you have taught, what is it you meta-communicate when you teach your classes? You told us you had classes that were more about the content of primary and secondary level math, others that were more about professional performance, such as planning, etc. When you are in classes that are more about primary and secondary level math content, what do you expect to model, or what have you seen yourself modeling?

From the point of view of focus on practice, we distinguish three types of questions: those having to do with Personalization, with Experience, and with Assumption. In the personalization questions, the critical friend seeks to inquire into the MTE’s motivations or personal connections with the subject under discussion or into decisions he has made for the class. During the first session, for example, discussions take place in connection with theorizing about certain teaching practices the MTE feels are effective, and the critical friend seeks to understand how those practices affect him.

**CF:** And how do you feel about that when you are standing in front of our students?

**MTE:** How do I feel about needing a theory to back me?

**CF:** Mmm? Do you feel more confident, do you feel calm?

Another type of questions is those aiming to evoke the MTE’s practice. These experiential questions made it possible for the teacher educator to bring into the conversation different past experiences or those
from other contexts, to be discussed in terms of the phenomenon in question. During the first session, the discussion develops around the modeling role the teacher educator feels he has for his students. To inquire why this is relevant, the critical friend invites the MTE to engage in reflective practice about his experience.

CF: Can you think of an episode in which you were impacted by the lack of coherence on the part of your teacher educators? At what point does [coherence] begin to be important for you?

Finally, the third type of questions focusing on practice is the one having to do with assumptions. These are questions in which the critical friend puts the MTE in situations he/she has not necessarily lived or experienced. The purpose is for the MTE to project a decision or reflection about a phenomenon, in spite of the fact he denies having lived that experience in particular. In the following quote from the third session, we observe an episode where this type of question is being posed, and in which the teacher educator and critical friend discuss what happens to students when subjects are left open in class, which is a habitual strategy of the MTE.

CF: But if you had a different group next year, this could happen to you, right? [MTE: Of course] Because in the final analysis, going beyond the group, your style of teaching leaves things open. So, there could be a group with which that doesn’t work … [MTE: How would I address that? what would you do in that case?]

Types of teacher educator reflection practices during critical friendship sessions

It was possible to identify two types of reflection practices dealing with questions and discussions triggered by the critical friend. On the one hand, in terms of depth, we found some reflective practices to be superficial, where the MTE did not engage in introspection with respect to what was being discussed, as opposed to some deeper ones in which the MTE engaged in introspection regarding the phenomenon under discussion. On the other hand, there were reflective practices related to the type of content of the MTE’s reflections, some related to professional aspects, and others of a didactic-mathematical type.

With regard to level of depth, the quote below comes from a moment in which the MTE gives an account of what he expects to get out of this critical friendship relationship and of the presence of questions that trigger the surfacing of beliefs. Even though one can observe a certain positioning on the part of the MTE, he does not delve much into the types of questions that he would like to explore.

MTE: No, that seems perfect to me, but I would specifically add to that [...] that if the change with respect to certain beliefs is made explicit, beliefs about which we have no prior idea what they are going to be, but if there is some change or at least a certain…if certain doubts arise in me, at least that. Because I don’t expect to clarify here all the doubts, I may have […] but perhaps, to the contrary, generate more questions.

Nevertheless, when the MTE continued his narrative, we observed an example of increased analysis and depth in his reflective practice, in which he contrasted his vision of the teaching role as a guide with the student’s autonomy. This vision reflects the evolution of the MTE’s role as a teacher educator
resulting from his professional experience, from staking his experiences, expectations, and challenges on that role.

MTE: I believe that I have become aware that, at least during certain moments, independently of classroom contexts, the student is to be the protagonist. I need to be more like a guide [...] I believe that generating autonomy, I don’t know if it can be said that way, but I believe that generating autonomy of thought or freedom of thought [...] I believe in that in my role as a teacher – I am thinking of the classroom – I believe that generating that freedom is of key importance.

On the other hand, in terms of the specific content of the MTE’s reflective practice, we observed an increase in statements having to do with professional aspects such as classroom experience related to curricular decision-making, or expectations regarding the vision of teaching that future teachers begin constructing during their formative years. Didactic-mathematical aspects, such as decisions with respect to teaching and learning functions, or a design proposal for a specific mathematical task, were discussed to a lesser extent. The following quote is an example of a MTE’s professional response while alluding to the importance of installing decision-making and questioning as a permanent professional practice, especially when working with student teachers:

MTE: Then how that decision-making act has an impact on designing a mathematical task with a specific purpose. The understanding that the fact of posing certain questions conditions your teaching, conditions the way you will be planning your teaching, and what the impact is I am going to have on my students. I believe that is what I would mostly expect to get out of this session with them. And what I would like to remain with, is the knowledge of having evidenced that the above [process] is taking place.

In connection with statements aimed at didactic-mathematical topics, the following quote is extracted from a moment in the second session in which the MTE analyzes the notion of a didactic variable and his role in decision-making:

MTE: That in itself is what is interesting, that one can handle that, manipulate that deliberately with a purpose, depending on the student, and that it makes an impact in the way that student learns. That’s the point. So, I understand that the didactic variable is an answer to that process. I believe that it is transcendental. What happens is that if you have not been taught what the didactic variable is, that does not necessarily make you consider it or not consider it. But it is important to make the student aware that this is present in their decision-making in the manner in which they design a mathematical task. It is present, and it is important to consider that.

**Discussion and Conclusion**

The results obtained show that the critical friend (Author 1) as well as the MTE (Author 2) develops a variety of strategies that allow them to build the critical friendship. On the one hand, the MTE is capable of articulating different levels of depth in his reflective practices and of diversifying their content in order to address professional aspects of a teacher’s work, as well as specific aspects of the teaching and learning of mathematics. This makes it possible to enrich Chapman’s approach (2008), to the extent of specifying the ways in which to examine the dilemmas of classroom practice.
questions voiced by the critical friend offer the teacher educator an opportunity to consider different points of view and to thus question his beliefs (Schuck & Brandenburg, 2020). At the same time, these results allow us to offer an unpacking of internal dynamics at work in the critical friendship relationship between MTEs. Table 1 summarizes the different types of questions posed by the critical friend and the different types of reasoning displayed by the MTE.

Table 1: Categories of questions and answers tables

<table>
<thead>
<tr>
<th>Purpose of the Questions (Critical Friend)</th>
<th>Types of reflective practice (Mathematics Teacher Educator)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding pedagogical reasoning</td>
<td>Understanding teaching practices</td>
</tr>
<tr>
<td>Exploration</td>
<td>Level of Depth</td>
</tr>
<tr>
<td>Discussion</td>
<td>Content</td>
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<tr>
<td>Delving into the topic</td>
<td>Descriptive</td>
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<tr>
<td></td>
<td>Analytical</td>
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<td></td>
<td>Professional</td>
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<td></td>
<td>Didactic-Mathematical</td>
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The relationship between questions and answers, and definitely between the purpose of questions posed by the critical friend and what the MTE displays during the conversation in connection with said questions, becomes a strategy that makes it possible to provide support to the professional learning of both actors within the critical friendship relationship. At the same time, it enables them to be aware of the personal resources they make available during the discussion, which they can project onto their own experience, thereby contributing to the improvement of their teaching practices. In addition, critical friendship is a tool that causes the teacher educators involved to evolve, as happened in this case in which they went from a dynamic based on questions to one in which they shared experiences, both mathematics teacher educator and critical friend having engaged in reflective practices that can potentially impact their teaching practices.

Although this study has contributed to unpacking some crucial aspects of critical friendship, it is important to establish the limitations and scope of the findings. For example, this study focuses on a particular case; therefore, it does not allow it to be generalized to the broader group MTEs. Nonetheless, the findings of this study may contribute to starting new discussions about generating spaces for MTE professional learning supported by collaborative work among them. Based on our experience in this self-study, and particularly in this critical friendship, we consider it necessary to articulate the existence of these relationships between teacher educators of the same program, safeguarding the time and conditions to make them happen. In addition, inclusion of various profiles of MTE has turned out to be an enriching element in the ensuing discussions and their analysis, which leads us to think that critical friendship may be used among other actors (practice tutors and students, teacher educators and students, etc.) for purposes of improving and growing the complexity of their professional learning.
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References


