

# Preparing Future Mathematics Teacher Educators to Develop Mathematics Teacher Educator and Researcher Stances

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## Abstract

The purpose of this paper is to support mathematics teacher educators (MTEs) to prepare their graduate students in becoming MTEs by creating a learning environment to develop epistemological stances. I present the components of my graduate seminar taught in a Practice-based Teacher Education program. The seminar aims to support graduate students to develop their stances and to address the “practice-theory” tension that exists between university courses and the work of teaching. I provide an overview of the class activities and present assignments that support graduate students in becoming MTEs.

## Background

Over the last 20 years, there has been more focus in the literature on becoming and being mathematics teacher educators, MTEs (Adler et al., 2005). Some individuals have recounted their own experience in becoming and being MTEs (see, for example, Tzur, 2001, and Chauvot, 2009). Meanwhile, others, like Chapman (2009), have pointed out that MTEs should reflect on facilitating the development of mathematical and instructional knowledge of prospective teachers.

This paper focuses on training MTEs from the point of view of an experienced MTE. What does it mean to *train* them? As part of their graduate studies, many MTEs have had the opportunity to teach mathematics or mathematics education at the undergraduate level, especially to prospective teachers (Chauvot, 2009). Too often, teaching at university level means lecturing a large number of undergraduate students. In this case, teaching might refer to presenting the content to be learnt by prospective teachers, so that they can teach what they know. It is about providing some kind of knowledge—not about developing a professional stance. There is no official or institutional support for supporting the development of teacher educators (Cochran-Smith, 2003). In fact, MTEs learn how to teach undergraduate students *by teaching them*. They also teach experienced teachers through workshops or professional seminars. They are supposed to know how to teach because they know the content. As indicated by Ball and Forzani (2009), teaching is not innate, but it can be learned purposefully. This paper presents the conceptualization of a graduate seminar that aims to support novice or prospective MTEs to develop their practices. By conceptualizing the components of the graduate seminar on the development of MTEs, this study contributes to the emerging literature on supporting MTEs’ learning.

## Teaching Is Creating a Learning Environment

Drawing on the French Didactics (Artigue, 1988; Brousseau, 1998), teaching is about designing an environment in which students can interact deeply with the content and participate in that interaction.

The teacher must know the learners and the knowledge to be learned so as to create an optimum learning environment and learning conditions. The learner should interact with the knowledge through tasks, materials, peers, and discussions (i.e., the green arrow between Learner and Knowledge in Figure 1)

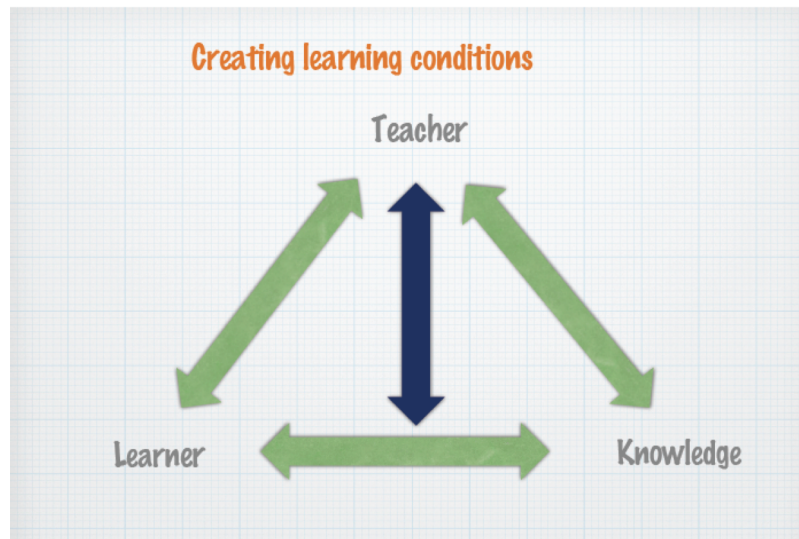


Fig. 1: Teaching is creating learning conditions between learners and the knowledge

It is not enough to have students just interact with their learning environment (Piaget, 1974); mindful thinking on these interactions is also needed to create a deeper learning experience. In Figure 1, the dark arrow shows where the teacher should focus the most: on the interactions between the students and the knowledge. This might involve adding a constraint to a task, eliciting student thinking, providing another kind of material or manipulatives, and asking why this works. Questioning students might lead to discussions of important concepts. Discussions are done either with a partner, within small groups, or as a whole class (Chapin et al., 2003).

In all cases, some effective teaching practices are needed to bring students further when communicating about mathematics. For instance, the teacher needs to listen and respond to students' ideas and contributions, since this discussion involves a co-construction process between the teacher and the students. It is more than a teaching monologue or a questioning "ping-pong exchange" between teacher and students (e.g., teacher questions, student answers, teacher asks another question, another student answers). Rather, it is about teaching toward an instructional goal:

In the back-and-forth routine dialogue among students and teacher that occurs in these routine kinds of interaction, the work of the teacher is to deliberately maintain focus and coherence as key mathematical concepts get "explained" in a way that is co-constructed rather than produced by the teacher alone. (Lampert et al., 2010, p. 131)

Thus, eliciting student thinking goes way beyond finding the answer: it is about students' understanding of the task, concept, or knowledge, and about justifying their thinking. It reveals where students stand at that point in their development. The challenge is to help them without telling too much, so that the knowledge is co-constructed by all participants and not just by the teacher (Brousseau, 1998).

I use this model, initially developed for teaching school students, to teach as an MTE and to teach to novice MTEs. In fact, I contend that being a mathematics teacher educator not only entails teaching undergraduate or graduate students, but also analyzing our practice in relation to our students' learning. It is about reflecting consciously on how we can introduce concepts to students in a way to support them in developing a conceptual understanding and have them think critically about those concepts.

### **Developing Teaching Practices by Developing Teaching Stances**

Inspired by the work of Ball and Forzani (2009) and Lampert (2010) on *Ambitious Teaching*, which focuses on the specialized work of teaching, I decided to develop a graduate seminar to help MTEs develop their own teaching methods using "Pedagogies of Practice" (Lampert et al., 2010; Kazemi & Wæge, 2015). I am a firm believer in "learning by doing," so that learning to teach must primarily be done by teaching in a safe environment. One way to put pedagogical practices first was to have undergraduate students rehearse a lesson before enacting it. The rehearsal is coached by the MTE, and I coach the MTE, so that the novice MTE can gain some insight and reflect about the practices they are trying to develop in the lesson. This is a great opportunity to foster MTEs' interactions with the knowledge. The rehearsal is followed by a written reflection on certain practices, providing the novice MTE with more feedback before the enactment. Other novice MTEs benefit from the rehearsals by participating as learners and observing like a novice MTE. At this point, they might play different roles, such as undergraduate students or teachers, which might be related to their different epistemological stances: former pupil or college or university students (Brown et al., 1999). As highlighted by DeBlois and Squalli (2002), there is another stance that novice teachers have: the teacher's stance. While novice teachers' experiences in elementary school mainly reflect a traditional teaching approach (former elementary school student stance), the university student stance focuses on getting good grades. Because the student-centered approaches usually promoted in university courses differ on how mathematics teachers learned mathematics, a tension might highlight this duality. The teacher stance focuses on teaching in relation to learning, using student-centered approaches and developed within university courses.

The construction of the teacher stance is challenging, because if novice teachers learn mathematics in a traditional manner, they will tend to reproduce how they learned without taking into consideration the advancement of Mathematics Education, such as conceptual understanding. Modifying their beliefs seems to be very difficult (Meirink et al., 2009). I studied this transition process and shed light on how novice teachers used teaching practices, while teaching mathematics to students during rehearsals, and guided them to understand some mathematical concepts (Savard, 2014a). It is through practice that they can truly understand the mathematical concepts to be learned, because they have to teach toward an instructional goal, both during the rehearsal and the enactment. They have to take into account every opportunity to foster students' thinking to make them understand the mathematical concepts.

For instance, the mistakes made by students were learning opportunities. Moreover, students invented processes to perform an operation or to solve problems. They had to reflect on their practice to have students reach the instructional goals. Thus, part of training MTEs is having them look differently at the mathematics they will teach. In my undergraduate course in Mathematics Education, I observed and studied this process, and found it was also necessary to develop the MTE stance (Savard, 2014b). In fact, becoming an MTE might also lead them to look differently at the mathematics they will teach. The MTE stance is guided by how to teach mathematics to students, which focuses on how students learn mathematics. In other words, designing learning conditions, such as presented earlier in Figure 1.

In addition, the MTE stance also implies problematizing and interpreting phenomena coming from the practice. In a sense, the researcher stance (Savard, 2017) is also strongly elicited along with the MTE stance. The MTE stance and the researcher stance should work together to support novice teachers to develop the teacher stance. This is quite a lofty goal, because it goes beyond teaching mathematics or mathematics education—it is about having an individual become a professional. This is a huge responsibility, because those novice teachers will one day teach mathematics to thousands of students.

Thus, training MTEs supports them in developing both their MTE and researcher stance. This is the foundation of the graduate seminar I designed. In this paper, I will use each component of Figure 1 to highlight how the seminar is conceptualized to help graduate students become novice MTEs.

## **The Graduate Seminar in Practice-Based Teacher Education**

I initially designed this graduate seminar for Mathematics and Science Education graduate students only. After one year, the course was open to graduate students from all disciplines. Each year, I collect oral and written feedback from students about their expectations toward the seminar at the beginning and end of the class. The students mentioned that they learned a lot from each other, and that having classmates from different disciplines in the seminar helped them to reflect about their own discipline. Having many readings on Mathematics and Science Education helped them develop their researcher stance, because they had to make sense of them in relation to their own discipline. At the end of the course, the students completed a survey on the relevance of each reading and assignment, which has allowed me to adjust and improve the seminar over the years. In this paper, I focus mainly on my MTEs, for whom this seminar is mandatory.

### **Learners**

My learners come from different backgrounds and different countries. English is often a second or a third language for them. They were schooled in different systems, so they have different visions of teaching and learning. They might be master's degree students or doctoral candidates. For many of them, this is their first class in Education, since they have degrees in Mathematics or Science. However, I also have students coming from Education without a degree in Mathematics or Science. Some of them are already familiar with the teaching practices presented in the seminar, because they did their undergraduate degree in our university. There are also teachers or school board consultants who are studying part-time,

as well as other students who don't see themselves as teachers because of their limited teaching experience. Those who are teachers have difficulty picturing themselves as graduate students; others only think of themselves as graduate students. Their focus is also quite different, because they are interested in teaching and learning Mathematics at different levels: elementary school, middle school, high school, college, or university. Some of them want to do a Master's degree project in Mathematics Education, not write a thesis. Students who are starting their Masters' degree in Mathematics Education usually don't have a lot of experience with Education research, thus their researcher stance is at the beginning stages.

Numerous students don't have any teaching experience, which is why it is so important to support them to develop their teaching practices to teach novice or experienced teachers. Many of the students enrolled in the course are not ready to become MTEs, and need to focus more on developing their teacher stance. Slowly, they start to develop the MTE stance during the coaching teacher's rehearsal.

### **Interactions Between the MTEs' Instructor and the Learners**

It is crucial to create a safe learning environment. Often, graduate students feel intimidated by the experiences of others, and think they may not belong or be able to contribute to the community. Furthermore, they are not sure what to expect from the instructor: another effect of the didactical contract (Brousseau, 1998). My role is to build a positive and professional relationship by giving them space and time to grow. For example, I make it known that I view mistakes as a great learning opportunity. Thus, when a graduate student makes a mistake, I use it to make connections with the teaching and learning process. I provide as much support as possible to my students, which makes it easier for them to contribute to class discussions.

At the halfway point of the semester, I also present my work on my own different epistemological stances. Usually, this is an important moment for the learners in this class, because they can position themselves to be more than a graduate student or a teacher—they see themselves becoming a MTE. After that, they explicitly name their epistemological stances in discussions, presentations, and in their writing. Below is a student's response from the last assignment, the E-portfolio:

Before this class, my teaching was crude, I mainly followed what I have experienced as a student and imitated my teachers to plan my lessons and classroom activities. At that time, I seldom thought about how to improve it. The most important thing I have learned in this class is my stance transformation, my stance changes from student to teacher and then to coach which shoulders three positions simultaneously. Although I am not a successful teacher at present, the change of my stance has a strong impact on my learning style and future teaching style. (Allie, first-year master's degree student)

### **Knowledge**

The knowledge presented has two different layers, because MTEs should teach novice teachers how to teach students in school. Thus, the first layer is about knowing how to support a teacher to learn how to teach mathematics to students and how to support them. The second layer is about knowing how to support novice teachers to learn how to teach mathematics to students. For each layer, knowing how

to use high-quality practices to support learners (students or teachers) is needed. To this end, the seminar aims to provide an overview of research on high-quality practices in teacher education, with a focus on practice-based teacher education. Practice-based teacher education addresses the “practice-theory” divide that often exists between university-based teacher education courses and the work of teaching by providing opportunities for graduate students to learn through engaging in teaching practices. Practice-based teacher education is organized around a core set of cross-disciplinary principles and practices (Table 1). The main goal of this course is to help students become teacher educators who, in turn, are able to support preservice and in-service teachers in implementing these principles and practices. At the same time, students will learn how to implement these principles and practices in their own teaching through apprenticeship opportunities. The learning outcomes are for students to:

- develop and improve their own pedagogy for teaching preservice and in-service teachers;
- develop their abilities to coach teachers on their teaching practices;
- reflect on the cultural, social, and political nature of knowledge in society;
- develop their critical stance toward pedagogies used for supporting students to learn;
- reflect on their own stances as teacher, educator, coach, researcher; and
- connect their teacher educator roles with their own research project (if applicable).

Table 1:  
*Principles and Practices of High-Quality Teaching Used as Framework in the Seminar*

**Cross-Disciplinary Principles and Practices of High Quality Teaching**

Principles of High-Quality Teaching <sup>1</sup>	Cross-Disciplinary Practices of High-Quality Teaching
<ul style="list-style-type: none"> <li>• Children are sensemakers.</li> <li>• Ambitious instruction requires clear instructional goals.</li> <li>• Teachers must know their students as individuals and as learners.</li> <li>• Teachers must design instruction and a learning environment that supports <i>all</i> children to do rigorous academic work in school and to have equitable access to learning.</li> <li>• Teachers must be responsive to the requirements of the school environment. At the same time, teachers should consider why schools function as they do and how schools might improve.</li> </ul>	<ul style="list-style-type: none"> <li>• Teaching toward an instructional goal</li> <li>• Eliciting and responding to student thinking                             <ul style="list-style-type: none"> <li>○ Pressing on student thinking</li> <li>○ Revoicing student thinking</li> </ul> </li> <li>• Orienting students to each other’s ideas and to the instructional goal</li> <li>• Positioning students competently</li> <li>• Establishing and maintaining expectations for student participation</li> <li>• Representing student thinking and key ideas</li> <li>• Using a public record of student thinking</li> </ul>

### Interactions Between an MTE and Knowledge

As an experienced MTE, I know that presenting theory is not enough for in-depth learning of the content. When learning mathematics, students must be actively engaged, and this includes university-level novice MTEs. Mathematical concepts always seem to be addressed explicitly. For instance, designing and reaching mathematical instructional goals requires a sound knowledge of mathematical concepts. The purpose of teaching is to make these mathematics concepts accessible to learners in a way that supports their learning process. Discussions of teaching practices were always done in relationship with learning mathematics. Mathematics then becomes the focal point for students. While I do not consider myself a

mathematician, I do have enough mathematical knowledge to support my undergraduate and graduate students. As an experienced mathematics teacher in elementary school, I have had many novice teachers in my classroom as a collaborative teacher. I am familiar with both theory (the university side) and practice (the field side). As an experienced researcher in mathematics education, I deepened my knowledge by doing research and using the literature to improve my teaching practices. For instance, my work on problem solving has allowed me to teach my undergraduate students how to teach additive and multiplicative structures (Savard & Polototskaia, 2017). As a graduate student supervisor, I know how to coach them to develop a mathematics teacher stance and/or researcher stance.

The mathematics teacher stance should focus on supporting students to learn mathematics in a conceptual manner, so that they understand what they are doing and can justify their reasoning. Another focus is to encourage students to think critically and creatively toward mathematics, and perceive mathematics as an important knowledge to use in their daily life (i.e., to enjoy intellectual challenges, as tools to make financial decisions, and to understand the world we live in). Mathematics is a fundamental tool for every citizen. One cannot fully participate in society (ten Dam & Volman, 2004) without having a certain amount of mathematical knowledge. Thus, teaching mathematics is a way to build a better society by supporting individuals to become responsible citizens.

The researcher stance should be developed in relation to the epistemology of teaching, learning, and mathematics. Not only is the researcher stance built on the practice of doing research—such as using a framework to analyze a teaching/learning phenomenon and using literature or evidence to support a claim—but also on using and analyzing the learning conditions to design a learning environment. Figure 2 shows how this environment changes, based on the knowledge to be taught.

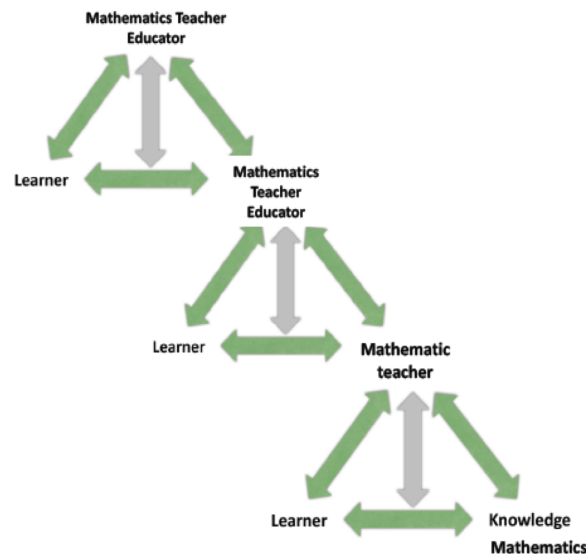


Fig. 2: Interactions between the MTE and the knowledge to be taught

## Learners' Interactions With Knowledge

The first classroom activity asks the students to write their own definitions of learning and teaching, which is followed by a whole-class discussion of their definitions. They are asked to keep this definition, since they will have to include it in their e-portfolio assignment. Other activities include designing and presenting a conceptual map on some readings, oral presentations, and rehearsals. Table 2 presents each assignment and the learning intentions to develop the MTE and the researcher stances behind them.

Table 2:  
*Supporting the Development of the MTE and the Researcher Stances*

Assignments	Learning Intentions
<p><b>Assignment A – Observing Tool:</b> In teams of two, graduate students develop an observing tool to use while observing teachers teach. They must validate the tool by using it while observing an experienced teacher. They also present it in class during a gallery walk.</p> <p>This assignment has four parts. In the first part, you will develop an observing tool to use when observing teachers while teaching a lesson. In the second part, you will use the tool twice: once while observing a teacher educator teaching a lesson to undergraduate students, and next while observing an experienced teacher teaching a 45-minute class (any level). In the third part, you will revise your observing tool based on your validation process. In the fourth part, you will present your revised tool in class during a gallery walk. Please provide a list of the references that you used at the end of your paper, and evidence that you attended both the classes. This assignment must be done in teams of two. You will submit a written report containing both versions of your tool (initial and revised), a reflection on your tool using the template provided, and the references.</p>	<p>Novice MTE will develop their MTE stance by:</p> <ul style="list-style-type: none"> <li>• selecting and justifying the choice of the practices chosen.</li> </ul> <p>Novice MTE will develop their researcher stance by:</p> <ul style="list-style-type: none"> <li>• selecting and justifying the choice of the format of the observing tool;</li> <li>• reflecting, validating, and revising the observing tool;</li> <li>• using literature to support their work.</li> </ul>
<p><b>Assignment B – Cycle of Enactment and Investigation:</b> In teams of two, they prepare a lesson, and enact it with either undergraduate students or teachers. They then reflect on their teaching practices. The rehearsal and the enactment are video recorded.</p> <p>In teams of two, you will create a lesson, enact it in front of undergraduate students or teachers, and reflect on your enactment. This assignment has five parts. In the first part, you will design a short lesson that will focus on orchestrating a short whole-class discussion for novice or experienced teachers. In the second part, you will</p>	<p>Novice MTE will develop their MTE stance by:</p> <ul style="list-style-type: none"> <li>• teaching novice teachers or teachers a lesson on mathematics;</li> <li>• designing a lesson for their learners;</li> <li>• design instructional goals;</li> <li>• rehearsing and enacting that lesson to reach their instructional goals;</li> <li>• reflecting about their own practices;</li> <li>• using feedback to improve their own practices;</li> </ul>



<p>rehearse, in class, your part of the lesson you designed. In the third part, you will write a short analysis of your rehearsal. This reflection will not be graded; you will, however, receive formative feedback on your reflection. In the fourth part, you will enact your lesson with novices or experienced teachers. In the fifth part, you will write an analysis of your enactment, not about your performance. A template with guiding questions will be provided. Please, provide a list of the references that you cited and quoted at the end of your paper.</p>	<ul style="list-style-type: none"> <li>• reflecting about their learners' learning process.</li> </ul> <p>Novice MTE will develop their researcher stance by:</p> <ul style="list-style-type: none"> <li>• reflecting about other practices while observing other rehearsals;</li> <li>• thinking critically about the mathematical content presented in other rehearsals;</li> <li>• analyzing;</li> <li>• using the teaching practices as a framework to analyze their and other practices live and on videos;</li> <li>• using literature to support their work.</li> </ul>
<p><b>Assignment C – Coaching Teachers:</b> In teams of two, they coach another team of two classmates on improving one teaching principle and one practice. They watch the enactment video of that team of two classmates. They select moments to watch with them and prepare questions to ask them, so they can reflect on the principle and practice they wanted to improve.</p> <p>This assignment will be done with the same classmate with whom you have done the Cycle of Enactment and Investigation assignment. You will coach a team of 2 classmates on improving one teaching practice. To do so, you will watch the enactment video of another team of 2 classmates. You will select moments to watch with them, <b>and prepare questions to ask</b> them so they can reflect on the practice they wanted to improve.</p> <p>This assignment has 3 parts. In the first part, you will plan your coaching session. In the second, you will facilitate a coaching discussion by watching with the members of the other team, moments from their enactment. In the third, you will reflect on your coaching practice and submit a report on your reflection. The report must contain at least 4 references read in class.</p>	<p>Novice MTE will develop their MTE stance by:</p> <ul style="list-style-type: none"> <li>• observing and analyzing a video of a classmate teaching novice teachers or teachers;</li> <li>• providing constructive feedback to the classmate;</li> <li>• coaching to support the classmate to reach an instructional goal.</li> </ul> <p>Novice MTE will develop their researcher stance by:</p> <ul style="list-style-type: none"> <li>• observing and analyzing a video of a classmate teaching novice teachers or teachers;</li> <li>• reflecting about other practices while coaching;</li> <li>• using the teaching practices as a framework to analyze a classmate practices on videos;</li> <li>• using literature to support their work.</li> </ul>
<p><b>Assignment D – Presentation of the Synthesis of Your Journey in Teaching and Coaching:</b> In teams of four (the same group of four classmates who did the Coaching assignment together), they present to the class a synthesis of their learning journey through the Cycle of Enactment, Observing Tool ,and Coaching assignments.</p>	<p>Novice MTE will develop their MTE stance by:</p> <ul style="list-style-type: none"> <li>• reflecting about their learning journey;</li> <li>• reflecting about their teaching practices;</li> </ul>

<p>In teams of 4 (the same 2 groups of 2 classmates who did the Coaching assignment together), you will present to the whole class a short synthesis of your learning journey throughout the Cycle of Enactment, Observing Tool, and the Coaching assignments. The presentation should be no longer than 40 minutes long. Each member of the group will have 8 to 10 minutes to present their synthesis. The presentation should highlight the learning process journey as a teacher and a teacher educator. You must link your journey with the readings of this class.</p> <p>The format of the presentation is your choice. Be creative. You may use any technology you want, including PowerPoint, Prezi, Movie Maker, or other. You are also invited to interact with the classmates during your presentation.</p>	<ul style="list-style-type: none"> <li>• reflecting about the feedback received and given;</li> <li>• interacting with their audience about their learning journey.</li> </ul> <p>Novice MTE will develop their researcher stance by:</p> <ul style="list-style-type: none"> <li>• selecting important points to present;</li> <li>• justifying their learning journey using evidence;</li> <li>• using literature to support their work.</li> </ul>
<p><b>Assignment E – E-Portfolio:</b> The e-portfolio should include: reflexive reports (12 pts.), and a statement of their teaching philosophy for teaching mathematics (6 pts.). The e-portfolio should also include all the documents from their assignments (A to D) as well as a table of contents, an introduction, and a conclusion.</p> <p>You will make an e-portfolio that will demonstrate how your learning and epistemological stances have changed over the semester. Your e-portfolio should include: 1) the reflexive report; 2) a statement of your teaching philosophy; and 3) all the written reports of your assignments. Your e-portfolio should also include a table of contents, an introduction, and a conclusion. This e-portfolio is a support to make sense of your learning in this course, and therefore, should reflect on how the assignments shaped your learning trajectory.</p> <p><b>1. Reflexive Report (12 pts)</b>          You will reflect on your own practices as a teacher or teacher-educator by answering three questions. This part of the assignment is expected to be a reflective report of your own journey. You are expected to make links between your learning, your teaching practices, and readings presented in this course. Please provide specific references to your content. You may use the readings from class and other articles, books, etc.</p>	<p>Novice MTE will develop their MTE stance by:</p> <ul style="list-style-type: none"> <li>• reflecting to the change of their professional identity;</li> <li>• revising their philosophy of teaching;</li> <li>• looking back to their learning journey on teaching and learning, to find out where they are now with their own teaching practices;</li> </ul> <p>Novice MTE will develop their researcher stance by:</p> <ul style="list-style-type: none"> <li>• organizing their thoughts about their learning journey;</li> <li>• analyzing their epistemological stances;</li> <li>• conceptualize their learning journey about teaching practices;</li> <li>• using literature to support their work.</li> </ul>

<p><b>Questions to be answered</b></p> <ol style="list-style-type: none"> <li><b>1. How did this course change your professional (teacher, coach, researcher, ...) identity?</b></li> <li><b>2. In your future teaching, which principle(s) do you want to focus on most, and why?</b></li> <li><b>3. In your future teaching, which practice(s) do you want to focus on most, and why?</b></li> </ol> <p><b>2. Statement of Teaching Philosophy</b>                  At the beginning of the course, you wrote your teaching philosophy. Please place a copy of this document in your e-portfolio. You will state a revised teaching philosophy, addressing in particular teaching/coaching teachers. Please refer to authors that helped you to define your statement.</p> <p><b>3. Build your E-Portfolio</b>                  Your e-portfolio is supposed to show your learning journey throughout this course and end in the direction you want to take as a teacher and a MTE.</p>	
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The seminar offers many opportunities for teamwork, especially with regard to the assignments. All the assignments are linked and follow a progression for supporting the students in developing their MTE and researcher stances. For each of them, MTEs are invited to use the in-class readings and other relevant literature. Thus, to study their own teaching practices, they will have to rehearse and enact them in the Cycle of Enactment and Investigation assignments. They are video recorded in both instances. To become more familiar with the teaching practices, they will have to observe—using an observing tool they developed—an experienced MTE teaching an undergraduate course in Mathematics Education. Next, they will coach a classmate using their observing tool while watching the video of their enactment. They will orally present a snapshot of their learning journey during those three assignments. Finally, they will do an e-portfolio to synthesize their learning process and make explicit their MTE and researcher stances. All assignments are described in detail—some have a template to guide their thinking reflection, and an assessment rubric is given for all of them.

All the assignments are designed so that they can build on their learning experiences. They thus need certain contents from previous assignments to complete other assignments. The following table summarizes the contents they need from previous assignments to complete each assignment, and the final products to submit for each assignment.

Table 3:  
*Relationships Among the Assignments*

	Assignment A	Assignment B	Assignment C	Assignment D	Assignment E
	Observing Tool	Cycle of Enactment & Investigation	Coaching Teachers	Presentation of the Synthesis	E-Portfolio
What you will need from previous assignments to complete the assignment	Enactment Video (B)		Enactment Video (B) Observing Tool (A)	Enactment Video (B) Observing Tool (A) Coaching Video (C)	Presentation (D) Written reports of: Cycle of Enactment (A); Observing Tool (B); and Coaching video (C)
Final products	Observing Tool Poster (gallery walk) Written Report	Enactment Video Written Report	Coaching Video Written Report	In-class Presentation	E-Portfolio

### Teachers Interactions on Learners' Interactions With Knowledge

In order to support novice MTEs to learn the content, I designed the activities made in class and the assignments. In class, I used principles and practices as a framework to foster novice MTEs' thinking. I elicited their thinking and asked them to justify their claims, and make connections between what they know—the principles and practices—and the readings. I wanted them to articulate their thinking in relation to their teaching practices and research project. For instance, I had them make a conceptual network between some readings in order to conceptualize key points. Before, during, and after each activity, I asked open-ended questions and facilitated a discussion around them. When I wrote important points on the board or used a public record of their thinking, I took pictures of the board and added them to the PowerPoint presentation. This was a way for them to reflect on the co-constructed knowledge.

The interactions that I made through the assignments are quite explicit. I provided feedback before, sometimes during, and after the assignments. The way I provided feedback before the assignments was by having a fairly detailed description of the assignment, which included providing the rubric that presents all the evaluation criteria and their weight. I also provided a template to guide their reflection. Over the years, students using a template have displayed more structured thinking, and did not miss important components of the assignment, such as evidence and references. I provided constructive feedback during and after the rehearsals to help support the students' learning. Moreover, I used the

rubrics and provided comments in every assignment, which I viewed as a way to engage in dialogue with novice MTEs.

## Concluding Remarks

I provided an overview of the seminar and the rationale behind my choices. I am still reflecting on it and about my practices. Over the years, I have learned that MTEs grow professionally and personally when they are asked to articulate their thinking using both MTE and researcher stances. Once they leave the graduate student stance, they are able to position themselves differently:

In my experience, the most impactful aspect of this assignment was the reflection template. You provided specific questions that we had to answer when reflecting. That really changed the way I looked at my practices, more analytically and less judging. (Allan, PhD student)

Therefore, programs that support MTEs should have practical components that foster the development of the MTE stance. More research is needed to connect theory and practice while developing an educator stance. To this end, it might be helpful to study the tensions that might arise between the MTE stance, the graduate student stance, and the teacher stance.

## Note

1. These principles and practices were borrowed—and, in some cases, adapted—from the Learning Teaching in, from, and for Practice Project: <http://www.teachingworks.org>.

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