

LESSON STUDY IN INITIAL TEACHER EDUCATION: DRAWING CONCLUSIONS FROM TWO PORTUGUESE EXPERIENCES

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This research aims to understand which situations created opportunities for prospective Mathematics teachers to develop their knowledge. Following a design-based research with two cycles, data was collected through participant observation, document collection, and individual interviews. The results show that establishing a focus on prospective teachers' learning created opportunities to develop their knowledge through discussing empirical articles, teaching the planned lessons, and reflecting on students' learning.

INTRODUCTION

Initial Teacher Education (ITE) must provide opportunities for prospective teachers (PTs) to develop knowledge about how to foster their students' learning. However, a big problem identified by PTs is “putting both theory and content into practice” (Chen & Zhang, 2019, p. 568). Lesson study, which is a collaborative and reflexive professional development process focused on students' learning, has shown benefits in ITE. This process encourages PTs to prepare lessons in detail and discuss their ideas, and allows them to enact what they planned, and to reflect on their practice. However, a better understanding is needed about how to structure lesson study, maintaining its efficacy and integrity, to create opportunities for the PTs to develop their knowledge being able to locate theory into practice (Ponte, 2017). Bjuland and Mosvold (2015) point out that is particularly important to pose “a research question targeting the student teachers' own learning” (p. 89). Thus, this research is based on establishing a focus for the lesson study regarding the PTs' learning. It pays particular attention to the opportunities created for PTs to develop their knowledge, in two Portuguese universities, answering the research question: Which situations created opportunities for the development of PTs' knowledge?

THEORETICAL FRAMEWORK

The PTs face several challenges in locating into the teaching practice what they learn in the ITE courses, raising a theory-practice gap (e.g., Bjuland & Mosvold, 2015; Chen & Zhang, 2019; Ni Shuilleabhain & Bjuland, 2019). For instance, a big challenge is related to planning and teaching lessons where “emphasis was placed on the use of cognitively demanding tasks ... the encouragement of productive interactions ... and the importance of listening respectfully to students' reasoning” (Stein et al., 2008, p. 316). Its core is the exploratory activities in which students are involved, based on demanding tasks as starting points for whole-class discussions. These *exploratory lessons* are usually structured in three phases: first, the teacher proposes a task; then, the students work autonomously in small groups; and, finally, the teacher selects some

students' strategies to discuss with the class, fostering their justifications, and does a final summary of the main ideas. However, selecting tasks that allow students to work autonomously, and fostering productive interactions in the classroom is not simple for PTs. They usually lack proper knowledge about what can happen during the lesson and "are regularly surprised by what students say and do, and therefore often do not know how to respond to students in the midst of a discussion" (Stein et al., 2008, p. 321).

To bridge this gap, it is important the PTs have school-based field experiences so they can learn "how to teach, and ... experience the difficulty of teaching" (Chen & Zhang, 2019, p. 551). Usually, ITE includes field experiences where the PTs put into practice their ideas and enact the lessons, under the mentorship of an experienced teacher. However, since they are developing knowledge about students and teaching practice, it is a challenge to plan and orchestrate lessons to foster students' learning (Bjuland & Mosvold, 2015). Thus, ITE has a responsibility of creating opportunities for PTs to develop their knowledge, based on field experiences and reflection on those experiences (Chen & Zhang, 2019; Ni Shuilleabhain & Bjuland, 2019).

Lesson study is a professional development process that aims to improve teaching and learning through planning, teaching, and reflecting on students' learning, through a collaborative work of a group of teachers. They start by identifying an issue in students' learning (e.g., a common difficulty) and study the related curriculum and research results, defining a learning goal. Then, they plan a *research lesson*, selecting, solving, and adapting tasks to be suitable to the lesson, anticipating students' strategies and difficulties, and preparing their interventions (e.g., questions to pose). After, a teacher teaches the lesson, and the others observe gathering notes to reflect on students' learning. By a deep exploration of different aspects related to students' learning, this reflexive environment allows the PTs to discuss their ideas about teaching practice, promoting the development of their knowledge through field experiences (Ni Shuilleabhain & Bjuland, 2019; Ponte, 2017).

Still, integrating lesson study in ITE demands adaptations, considering the settings of each university. The process tends to be simplified, which may compromise its unique characteristics and benefits. But, without adaptations, it is not possible to carry it out because of the specifics of each program and the aims of preparing PTs (Ponte, 2017).

There are several experiences of lesson study in ITE, with different contexts and designs, using diverse theoretical frameworks (see Ponte, 2017). These lesson studies usually have aims concerning professional or didactical aspects, as the development of PTs' knowledge or their reflective practice. However, "such aims are not indicated in an explicit way in most studies" (Ponte, 2017, pp. 173-174). In addition, the lesson studies usually focus on the planning phase, on the reflection phase, or both, which establishes the main activities during the process (Ponte, 2017). But these foci seem to emerge by the required adaptations of integrating lesson study in each specific ITE program or seems to be a choice of teachers educators. For instance, in Chen and Zhang's (2019) study, "lesson planning ... is a central focus in learning how to teach"

(p. 550). The authors structured the lesson study in two courses and asked the PTs to plan a lesson based on the knowledge they developed by being taught about “the process of lesson planning, the frame of a lesson plan, and the specific guiding of each aspects” (p. 556), to teach that lesson for their colleagues, through microteaching.

Although the focus of a lesson study is students’ learning, it must happen under the development of teachers’ knowledge (Lewis et al., 2019). So, it is important not only to define a learning goal regarding students, but also to establish a broad long-term goal for the teaching and learning process, focused on the PTs’ learning. For Bjuland and Mosvold (2015), “identifying a research focus for the students teachers’ own learning” (p. 88) is an important element of lesson study in ITE. This is an idea also shared by Lewis et al. (2019) for in-service teachers: “[the research theme] helps reconnect educators with the goals that are really vital to them” (p. 21). Therefore, by investigating a certain aspect of their own learning, PTs can guide the lesson planning to the research focus and think of it as “an empirical investigation of their own teaching and learning” (Ni Shuilleabhain & Bjuland, 2019, p. 3). Thus, it seems to be important to define two main dimensions of goals for lesson study in ITE. The first dimension is related to the *definition of a learning goal for the research lesson*, regarding students’ learning. It can be related to a usual difficulty they have on a specific topic, or it can be focused on fostering their skills as reasoning processes. The other dimension concerns a broad long-term goal which implies an *establishment of a lesson study focus regarding PTs’ learning*, to foster the students’ learning based on the development of PTs’ knowledge.

METHODOLOGY

This research follows a qualitative approach as a design-based research (Cobb et al, 2016) with two design cycles, in two Portuguese universities. It aims to provide insights on how teacher educators can create opportunities to promote the development of PTs’ knowledge, establishing a focus for lesson studies regarding PTs’ learning. So, the interventions were structured on lesson study experiences with a particular focus on creating opportunities for the PTs to develop their knowledge. At the end of Cycle I, a retrospective analysis was done considering the data collected, similar empirical studies, and confronting with theoretical perspectives.

In each university, the participants were secondary school Mathematics PTs supervised by a teacher educator who accepted to carry out the lesson study. They observed several lessons taught by experienced teachers, at the field practice. The facilitator role was shared by teacher educators and the first author (also as researcher). In Cycle I, Mónica and Olívia, planned a first lesson for Olívia to teach, and then both planned a second lesson that both taught to different classes. Sílvia, Lila and Maria, in Cycle II, planned and taught three lessons each, in different classes.

Data collection includes participant observation by the researcher (with researcher’s journal and audio recordings), document collection (lesson plans and written reflections), and individual interviews at the beginning and at end of the lesson studies.

All the necessary permissions were requested, and the names are all pseudonyms.

The data analysis is organized as thematic episodes from the two lesson study experiences. First, it is presented the focus of the lesson study regarding the PTs' learning, describing how it was established. Then, it is discussed the lesson planning work, having as background the established lesson study focus regarding PTs' learning. Finally, considering the PTs' reflections, it is pointed out what can be improved for the next lesson study experiences and what knowledge the PTs developed.

TWO LESSON STUDY EXPERIENCES IN TEACHER EDUCATION

Cycle I

Establishing a lesson study focus regarding PTs' learning. To prepare the intervention, the researcher and the teacher educator met to define the aspects to explore and to organize the sessions attending to the field practice agenda. Considering that exploratory lessons usually raise challenges for the PTs, the teacher educator suggested exploring this teaching approach. Therefore, the facilitators proposed the analysis of the curriculum, and the analysis of an article regarding a teacher's learning about exploratory lessons. During the discussion of the article (Session 2), Mónica and Olívia showed a superficial understanding of exploratory lessons:

Olívia: The students' previous knowledge is important. It's forwarding to a reflection.

Mónica: Instead of the teacher being the main guide of the lesson, he guides the students to... he is no longer the main figure in the lesson, the students are.

Additionally, they drew the first lesson plan describing what should happen in the lesson and did not plan moments for students to work autonomously on the proposed task or to share and discuss their mathematical ideas:

Four students will be selected randomly. It will be explained that each one will have to build a cube. ... As soon as they finish it, the selected students will have to go back to their places. The task will be solved by the whole class. (Mónica and Olívia's first lesson plan)

Thus, the lesson study focused on exploratory lessons' structure and purposes to promote the development of PTs' knowledge about it, based on discussions on empirical articles and careful lesson planning work for the research lesson.

Planning a lesson based on the lesson study focus. The facilitators wanted to promote the development of PTs' knowledge about planning exploratory lessons. Since the task proposed is the starting point in an exploratory lesson, they suggested the PTs select different tasks to critically analyze their strengths and weaknesses. They aimed the PTs to be able to design questions that allow several solving strategies to foster students to share and to justify their ideas during the whole-class discussion. By analysing the tasks, the PTs showed their concern about students' motivation:

Does this motivate the students? ... there are things that we see right away they don't care about. And there are others they are interested in. (Mónica, Session 4)

So, they investigated their students' interests and sociocultural contexts, to design an interesting task for them, developing their knowledge about the students.

The facilitators also suggested discussing another article about aspects that should be considered when planning an exploratory lesson. After the discussion, the PTs reformulated their lesson plan structure, organizing it in the three moments of an exploratory lesson and using the scheme proposed which involved tasks and learning activities, expected duration, students' activities and possible difficulties, teachers' answers and aspects to pay attention, and goals and assessment. Also, the PTs paid attention to some aspects disregarded on the first lesson plan, as students' difficulties, as well as the preparation of teachers' interventions to foster the students' justifications. So, the discussion of the article seemed to influence the PTs' lesson plans and, consequently, the development of their knowledge about planning exploratory lessons.

Reflecting on the lesson study experience. At the end of the lesson study, Mónica stressed out in the final interview that “we should have better prepared the communication part ... For example, in a specific [students'] question, what will be the keyword to use to help them? ... We had only written ‘the teacher must guide to...’”. The teacher educator also mentioned that the whole-class discussion needed to be better prepared and added that “[the reflection phase] should take longer ... it should be more systematic”. Thus, the retrospective analysis arose two main issues to be considered in the next lesson study: promoting a careful preparation of whole-class discussions and creating more opportunities for the PT to reflect on students' learning.

Notwithstanding, Mónica highlighted she learned “to handle everything, ... whether it is an exploratory lesson or not, I think [I've learned] the teaching approach for each lesson.”. Also, Olívia said she developed their knowledge about “The planning part ... I used to plan as running text and it was very confusing... and there were many pages! And so, in a table, it became more succinct”. So, for these PTs, knowledge about teaching approaches and lesson planning was developed during the lesson study.

Cycle II

Establishing a lesson study focus regarding PTs' learning. To prepare the intervention, the researcher conducted interviews with the PTs and shared the principal ideas with the teacher educator, as well as some issues that arose from the previous experience. Thus, the lesson study was structured considering the PTs' themes for the Final Report, namely to foster students' reasoning processes and classroom communication and the two main issues pointed out in the previous lesson study.

To promote a careful preparation of whole-class discussion, the facilitators asked the PTs to prepare their interventions considering as starting point a detailed anticipation of students' strategies and difficulties. Then, they suggested design tasks that allow students work autonomously in small groups, using different solving strategies and several representations, to foster their reasoning processes and explanations during the whole-class discussion. To create opportunities to reflect on students' learning, the

facilitators proposed pre-lesson and post-lesson reflection guides, focusing on PTs' themes for the Final Report. They also proposed an additional written reflection, based on lesson video recordings, for the PTs reflect on students' learning and look for strategies for improving their practice. They also encouraged them to plan three lessons each, to be taught, so they could improve their practice based on their reflections.

Thus, the lesson study focused on foster students' reasoning processes and classroom communication, to promote the development of PTs' knowledge about it, based on reflections developed before and after the lessons to improve their teaching practice.

Planning a lesson based on the lesson study focus. Encouraging the PTs to plan three lessons each created lesson study microcycles: plan the lesson based on a pre-lesson reflection guide, teach the lesson, discuss the lesson based on the post-lesson reflection guide, write a reflection considering the students' learning during the lesson to look for strategies for improving their practice, and repeat the process for the next lesson.

The PTs began to select tasks more suited to the learning goals and to adapt them to foster students' reasoning processes and communication, namely during the whole class discussions. They also began to prepare their interventions to support students in the whole-class discussion, challenging them to confront their mathematical ideas with their colleagues, without validating their reasonings. For example, in her first lesson plan, Lila proposed a task with a quadratic function for students to determine the maximum value. If they have difficulties, Lila would "ask them to search on their notebook how to calculate the parabola's vertex", giving them the procedure. In her third lesson plan, in a similar situation, she wrote "I will suggest them to sketch the situation", promoting different representations to foster students' justifications.

The written reflections also seemed to have contributed significantly to the development of PTs' knowledge, as we can read on Maria's third written reflection:

These moments [of discussion] are often scarce ... there may be a tendency of the teacher to explain ... we must try to make the students express orally what they thought.

When they reflected on specific lesson moments and wrote it down, confronting with what was planned, the PTs tried to realize what happened and its influence on students' learning, drawing conclusions to improve their practice. So, these microcycles seemed to influence the development of the PTs' knowledge, namely about lesson planning.

Reflecting on the lesson study experience. In the final interviews, the PTs pointed out the biggest problem of being involved in a lesson study experience is managing the time with the field practice. Maria also added that "even when I read some articles about lesson study, I didn't realize it. Knowing the process is very different than carrying it out". For her, it would be important having other lesson study experiences or attend conferences about it. Notwithstanding, they valued the reflections they made, before and after the lessons, as Maria wrote in her first written reflection:

This reflective process that I must do, to justify myself to other people and to explain why I took those options, makes me go to the lesson with much more appropriate activities.

Focusing on students' reasoning processes and classroom communication, made the PTs rethink aspects as the tasks to foster the students' justifications as well as how to challenge the students to foster classroom communication. In particular, Lila highlighted in her written reflection that "during the whole-class discussion, the anticipation of the different students' solving strategies ... allowed me to be better prepared and to support students more easily". Maria and Sílvia also valued the anticipation of students' work, pointed out the benefits of having the opportunity of redoing it, as Sílvia said in the final interview:

I began not realizing what difficulties students might have. For the second lesson plan, [anticipating students' difficulties] became easier because I had already taught a lesson.

For these PTs, knowledge about students and lesson planning was developed during the lesson study microcycles, based on the systematic improving on anticipation work and considering their pre and post-reflections on students' learning.

CONCLUSION

Through this research, some conclusions emerged about carrying out lesson study in ITE, namely situations that created opportunities for PTs to develop their knowledge.

Discuss empirical articles. In Cycle I, the diagnosis of the PTs' lack of knowledge about exploratory lessons emerged by the discussions on an article, which became the focus regarding PTs' learning. Those discussions led these PTs to carefully select and adapt tasks to the lesson and to rethink how to plan this kind of lesson.

Teaching the lessons planned. Teaching the lessons led the PTs to put into practice their planning and to observe students' work. In particular, the microcycles (Cycle II) created opportunities for the PTs to develop knowledge about students' difficulties.

Reflecting on students' learning. These experiences allowed the PTs to reflect on the lessons taught based on students' learning rather than a simple description of what happened. In Cycle II, they were able to identify what should be improved in the next lessons plans, namely the preparation of whole-class discussions. In Cycle II, considering their themes to write down their reflections on students' work gave them further data on students' learning. Additionally, in this cycle, the regular moments of reflection encouraged the PTs to redefine strategies to improve their practice.

The results show that planning, teaching, and reflecting on a lesson are important opportunities for the PTs to develop their knowledge. Nonetheless, the cooperating teachers were not able to attend the sessions, which was a limitation of this research. Results also show that a lesson study cycle, for itself, does not give an immediate effect on the PTs' knowledge. Thus, the development of PTs' knowledge may benefit from more than one lesson study cycle, enhanced by the discussions and its reflexive nature. In Cycle II, the PTs benefited from the reflection guides, as it incited them to justify their choices for the lesson considering students' learning, and led them to view their formative process as an empirical investigation of their own teaching and learning.

The adaptations on lesson studies were made having in mind the ultimate goal: foster the students' learning by developing PTs' knowledge. Establishing a lesson study focus regarding PTs' learning was important to structure the process considering these PTs' lack of knowledge and their wills to foster students' learning. So, it can help the teacher educators to focus the lesson study activities, by being established at the beginning of the lesson study, considering some identified PTs' lack of knowledge or an issue they want to develop. This lesson study focus can be related to a specific Mathematical content topic, or it can be drawn by aspects related to the teaching practice (e.g., selecting appropriate tasks, planning lessons, orchestrating students' ideas, fostering students' reasoning processes, or even improving teaching through technologies).

This research provides insights on how lesson study may be carried out. The lesson studies were prepared aiming to locate the theory of the university modules in the practice of planning, teaching, and reflecting on students' learning. Despite the significant differences, the specificities of each experience provide insights on how teacher educators can create opportunities to promote the development of PTs' knowledge, establishing a focus regarding their learning.

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