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Establishing links between research and practice: Lesson study as a professional development process

Estabelecendo ligações entre a teoria e a prática: O estudo de aula como processo de desenvolvimento profissional

Établir des liens entre la théorie et la pratique: L'étude de classe comme processus de développement professionnel

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Abstract

Lesson study is a professional development process that has become widely disseminated worldwide, corresponding to a small investigation of participants' professional practice. In this article, our objective is to present aspects of the work of a lesson study, namely in its preparatory phase of documentation and preparation of the lesson plan and in its phase of post-lesson reflection. We pay special attention to the work of selecting and elaborating tasks, the foresight of the strategies and difficulties of the pupils, and the preparation and conduction of the whole-class discussion. We also show how the participating teachers see the lesson study. We point out the necessary conditions for undertaking lesson studies and show how the lesson study, as a formative activity based on practice, can be a powerful teacher professional development process.

Keywords: lesson study, professional development, task, whole-class discussion, reflection

Resumo

O estudo de aula é um processo de desenvolvimento profissional que tem vindo a conhecer larga divulgação em todo o mundo, correspondendo a uma investigação dos/as participantes sobre a sua prática profissional. Neste artigo, o nosso objetivo é apresentar aspetos do trabalho de um estudo de aula, nomeadamente na sua fase preparatória de documentação e elaboração do plano de aula, e na sua fase de reflexão pós-aula. Damos especial atenção ao trabalho de seleção e elaboração de tarefas, à antevisão das estratégias e dificuldades dos/as alunos/as e à preparação e condução da discussão coletiva. Mostramos, também, como o estudo de aula é visto pelos/as professores/as participantes. Apontamos as condições necessárias à realização dos estudos de aula e mostramos como o estudo de aula, como formação baseada na prática, pode ser um poderoso processo de desenvolvimento profissional de professores/as.

Palavras-chave: estudo de aula, desenvolvimento profissional, tarefa, discussão coletiva, reflexão

Résumé

L'étude de leçon est un processus de développement professionnel qui a connu une large diffusion dans le monde entier, correspondant à une petite enquête des participants sur leur pratique professionnelle. Dans cet article, notre

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objectif est de présenter les aspects du travail d'une étude de leçon, notamment dans sa phase préparatoire de documentation et de préparation du plan de lesson et dans sa phase de réflexion post-leçon. Nous accordons une attention particulière au travail de sélection et d'élaboration des tâches, à la prévoyance des stratégies et des difficultés des élèves et à la préparation et à la conduite de la discussion collective. Nous montrons, également, comment l'étude de leçon est perçu par les enseignants participants. Nous soulignons les conditions nécessaires à l'accomplissement des études de lesson et montrons comment l'étude de leçon, en tant que formation basée sur la pratique, peut être un puissant processus de développement professionnel des enseignants.
Mots-clés: étude de leçon, développement professionnel, tâche, discussion collective, réflexion

Introduction

Lesson study is a teacher professional development process that has come to know wide dissemination worldwide (Huang et al., 2019). In Japan, the country from which it originates and where it is widely practised, lesson study is the central element of a set of professional development activities and processes widely supported by public education policies (Stigler & Hiebert, 1999).

The central element of a lesson study is the activity of a small group of teachers (usually between three and eight teachers) who identify a recurring problem in their students' learning and seek to find ways to overcome it. To do so, they carry out a small investigation, trying to document themselves about this learning problem and to know previous proposals already tested. Based on these elements, duly considered, the teachers carefully draw up a lesson plan that one of the group members puts into practice with his/her students. The lesson called the "research lesson", is observed by all members of the group, giving special attention to the students and, subsequently, is the object of in-depth reflection based on the observations made (Fujii, 2018; C. Lewis et al., 2019; Murata, 2011). The work often ends with disseminating the experience with other teachers, in congresses and with writing reports and articles in professional and scientific journals (Stigler & Hiebert, 1999).

This general process admits many variants, such as the realisation of a set of lessons in a teaching sequence, the realisation of the research lesson by several teachers of the group, taking advantage of the experiences they are carrying out, or even being undertaken with a multifaceted focus involving not only learning of a discipline but also transversal and multidisciplinary aspects and themes such as inclusive education (Norwich et al., 2020). Lesson studies can be conducted with in-service teachers, future teachers, and mixed groups involving diverse stakeholders (Burroughs & Luebeck, 2010).

The lesson studies correspond to an international movement with its own organisation (WALS – World Association of Lesson Studies) [1] and a highly prestigious scientific journal (IJLLS – International Journal for Lesson and Learning Studies)[2]. In Portugal, lesson studies have been carried out since 2011, mainly from the impulse of the *Instituto de Educação da Universidade de Lisboa* with research on a variety of issues, from the professional learning carried out by teachers and future teachers to the conditions necessary for the

[1] https://www.walsnet.org/
[2] https://www.emeraldgrouppublishing.com/journal/ijlls

functioning of this formative process and the perceptions of the participants (e.g., Cardoso et al., 2023; Gomes et al., 2023; Martins et al., 2023; Ponte et al., 2016, 2023).

In this article, we present some aspects of the work of a lesson study, namely in its preparatory phase of documentation and preparation of the lesson plan and in its post-lesson reflection phase, and we also present the perspectives of participating teachers. We seek to show how lesson study, as practice-based teacher education, can be a powerful professional development process for teachers.

Lesson study as practice-based teacher education

The perspective of practice-based teacher education, proposed by Ball and Cohen (1999), assumes a close interconnection between teacher and future teacher education and professional practice experiences. These experiences can take place in very different ways. They can be materialised through practices in a natural context by preparing, teaching and reflecting on lessons taught to regular school students. They can be experiences of simplified practice such as teaching small groups of students, teaching small moments of lessons, microteaching, etc. They can also be realised through representations of practice and the use of artefacts emerging from practice, such as examples of written student work, lecture videos, and written transcripts of class dialogues (Grossman et al., 2009). In this perspective, practice is a starting point for reflection and theorising. Still, it is also a point of arrival since the formative process aims to improve or transform that practice.

Practice-based teacher education may assume particular characteristics close to research processes on the participants' practice (Cochran-Smith & Lytle, 2015; Ponte, 2002; Zeichner and Noffke, 2001). Lesson study is a practice-based formative process that can be conducted by one of the teachers of the group or by a person external to the group (often referred to as "facilitator"; J. Lewis, 2016) and that addresses the professional practice of these teachers focusing on a problem of student learning. In a lesson study, teaching practice plays a central role through a carefully prepared lesson, then taught and observed, and finally subjected to in-depth analysis. This work assumes an investigative nature (Ponte, 2002) since it begins with the definition of a starting question (as in all research work), proceeds with a preparatory work that includes a literature review, the search for relevant resources and detailed planning of the lesson (preparation phase analogous to research), which is followed by the teaching and observation of the lesson with data collection (comparable to the realisation of a scientific experiment or another process of data collection), culminating in the reflection on the lesson (data analysis as in scientific activity) and the dissemination of the experience (dissemination of scientific results). That is, on a small scale, a lesson study follows a process analogous to that of a scientific investigation.

In practice-based teacher education and, in particular, in lesson study, research is always present, namely in the study of curricular guidelines that help guide the entire teaching process, in analysing scientific and professional articles related to the problem posed and in identifying and evaluating didactic materials of

various nature. This study of the documents that the research results and the theory that informs them begins by being present in the work carried out by the teachers, more concretely in the lesson's preparation stage. But it is also present in the analyses and reflections made from artefacts of their practice and observations of this practice from the research lesson.

Methodology

For this article, we selected episodes and data from several lesson studies that followed, in their general lines, the steps indicated in the introduction of this article. The participants (indicated here by pseudonyms) are mathematics teachers (teaching grades 5 and 6) who have been involved in different lesson studies. All situations relate to mathematics lessons, although using examples from various subjects would be possible. The investigation followed a participant observation design (Goetz & LeCompte, 1984; Jorgensen, 1989). The facilitators of these lesson studies are mathematics teachers doing their PhD at the *Instituto de Educação of the Universidade de Lisboa*. Data were collected by participant observation with audio recordings of the lesson study sessions, the preparation of a research journal, and interviews. Data analysis was performed by content analysis (Bardin, 1979) and thematic analysis (Goetz & LeCompte, 1984), particularly in the preparatory phase of documentation and preparation of the lesson plan and in the phase of post-lesson reflection.

Moments of work in a lesson study

Designing tasks and anticipating students' strategies and difficulties

In a usual curricular perspective, the work in mathematics in the classroom is processed from explanations and examples given by the teacher, which lead to procedures that, later, the students are called to practice, doing exercises. From an innovative curricular perspective, this work is processed from tasks proposed by the teacher and carried out autonomously by the students (individually, in pairs, or small groups). The students' mathematical activity during this autonomous work serves as the basis for a whole-class discussion where the students present their solutions, which are analysed and contrasted to identify the most powerful solution from the mathematical point of view, which is then the object of the final synthesis. This type of lesson corresponds to what in Portugal is usually called the "exploratory approach" (Ponte, 2005), equivalent to expressions such as "inquiry-based teaching", "reform mathematics", "ambitious teaching", and others used in different countries.

This innovative approach posed many challenges for teachers and was therefore selected by the group as the focus of the lesson study. As a first step to designing this type of lesson, teachers must understand that

students can learn from their work on tasks and not only from the teacher's explanations. To broaden the vision of teachers on what tasks to propose in the classroom with this aim, we proposed task 1 right at the beginning (session 2) of a lesson study with teachers of grades 5-6. This task caused great strangeness in the teachers. In a task on rational numbers, students are usually given an object representing a unit and then asked to represent various parts of that object. But in this case, the object is not given – what is given is a fraction of the object.

FIGURE 1

Representing fractions, a paper strip

The figure represents $\frac{3}{4}$ of a paper strip.

Represent, $\frac{1}{2}$; $\frac{2}{3}$; $\frac{4}{3}$ and $\frac{3}{2}$ of that strip.

Explain your reasoning.

This strangeness was immediately apparent in the following dialogue, especially in the first intervention from Maria:

> Maria: How would they approach this? This is 3/4 and now how do you ask 1/2? How will they…?
> Tânia: First, try to add…
> Inês: We divide this part…
> Facilitator: First, they need to understand what is, therefore, the….
> Teachers: [At the same time] The unit!
> Tânia: That this is not a unit.

For a moment, the teachers had to think about how to mathematically solve the task. After a few moments of reflection, Tânia suggested a possible strategy, which is not the only one[3] but is certainly the strategy that is most within the reach of the students: From the given representation $\frac{3}{4}$ of the paper strip, begin by representing $\frac{4}{4}$ of that strip, that is, the unit. From the representation of the unit, it would no longer be too difficult to obtain representations of the other fractions indicated (although dealing with improper fractions such as $\frac{4}{3}$ and $\frac{3}{2}$ is always a challenge for many students). This task drew the attention of the teachers to a concept that is often seconded in the teaching-learning process, the process of reconstruction of the unit, but which is fundamental for effective learning of the rational numbers in their different representations (here, the fraction and the pictorial representations and natural language are used). It is necessary to realise how one obtains the part from the whole and how to obtain the whole from the part.

In the continuation of the discussion, the teachers analysed the possible difficulties of the students:

[3] Another strategy would be to work exclusively on the fraction representation, but it would not be expected that students would use this strategy because it depends on more advanced mathematical knowledge.

Maria: They immediately divide in four.
Teachers: Yes, exactly!

Maria indicates the solution strategy of many students: to divide the given strip into four parts, thus obtaining wrong answers. This strategy is based on the usually hurried reading that students make of the statements of the questions, leading to incorrect interpretations.

Next, we asked the teachers if they wanted to propose this task to their grade 5 and 6 students. At first, they thought it was not because they considered the task too difficult for their students. However, after some discussion about the possible strategies and difficulties of the students and how to help overcome them, and some encouragement on the part of the facilitator, they become willing to do so. In the following session of the lesson study, they reported the results, indicating that in all classes, there were students who could do the task and show their colleagues how they did it. This observation of the results of putting into practice innovative work processes had, of course, a great impact on the teachers who, thus, became much more available to consider a broader set of tasks than what they usually did. They also realised that, in a lesson, the teacher is not necessarily the source of all knowledge. Thus, creating opportunities for creating new mathematical knowledge from students' work is important. For this, it is necessary to carefully plan the lesson, know possible strategies, and anticipate possible student difficulties.

Preparing whole-class discussions

An especially important moment of an exploratory lesson is the whole-class discussion from when the students can work autonomously on the task. It is not necessary that all students were able to solve the task completely, and many may have come up with wrong solutions. During the period of autonomous work, the teacher can go through all the pairs or groups of students and support them in understanding the task (what information is given, what is requested, and what operations or transformations are admissible in the data to arrive at the solution). In this way, at the time of autonomous work, the teacher is not expected to provide the solution to the students, which would nullify the interest of the whole-class discussion, but rather to help them think so that they can find a solution for themselves. The whole-class discussion aims to compare different solutions and analyse errors with the participation of all students, so the teacher should not direct all students to a single solution.

The order in which students present their solutions is crucial in the whole-class discussion. A perfect solution that completely solves the question posed completely nullifies the discussion from there. All incomplete or error-ridden solutions shown afterwards are necessarily devalued, putting the students who present them in an unpleasant situation. Therefore, it is important that solutions can move on growing, valuing the positive things they have but identifying their errors and omissions. In this context, the facilitator proposed to the teachers the consideration of which of the two solutions of a task also on rational numbers (Figure 2) would be to be analysed first in the whole-class discussion.

FIGURE 2

Students' solutions for whole-class discussion

Task: Fold a paper strip in 2, 4 and 8 equal parts. Represent the parts that you got in different ways.

It should be noted that the two groups responded correctly concerning two-part folding. For the 4-part folding, group A presents a mistake in the decimal representation when writing 0.4. It is a very common mistake to convert a fraction of type $\frac{1}{a}$ to 0.a. Group B has the correct answer of 0.25, and it would be interesting to know how the students obtained this answer in the discussion. For the 8-part folding, there are more mistakes in both answers, more in group A (which misses the answer in percentage and makes a new error in the decimal) than in group B (which now misses the decimal number). Two of the teachers would choose to start by presenting the group B answer, arguing:

> Tânia: Oh! Why would I choose B? I would choose B because it is the one that is more correct; mathematically, it is the one that is more correct.
> Inês: It's what's best at the presentation level and at the writing level as well.

In turn, Francisca presented a different perspective:

> But then you also must bring these to attention. To take the mistakes, from my perspective, is not to say that this is wrong, it is not to demean the children, it is nothing of the sort. It's trying to see the mistakes and trying to clarify as many students as possible for those mistakes because it's not just these that are going to do this kind of reading; there are many more in the class that are going to do the exact same kind of thing. If I take right away what is right, I almost standardise it all and do not take the idea, the conception, that there is behind such a half, is not it?

This intervention by Francisca is very much in line with the perspective that emerges from the research we presented above. Therefore, of course, we reinforced Francisca's arguments but left it open that the group could go deeper into this issue on future occasions. Letting the group evolve at its own pace is an important condition to ensure the full spontaneity of all participants in the lesson study, favouring their professional learning.

Reflecting on a lesson

In a lesson study, the post-lesson reflection stage allows an analysis of the data from the observation of the research lesson and, sometimes, of excerpts from its recording and the materials produced by the students. Ideally, the lesson, which is conducted by one of the participating teachers and observed by the other colleagues and the facilitator, should be the subject of reflection on the same day or in the following days, favouring a discussion richer in detail due to its temporal proximity to the event. The records of this observation provide information about the students' mathematical activity to be the target of reflection and can be written more freely or guided by previously defined indicators.

When leading this reflection session, the facilitator should encourage the participation of teachers through more general contributions about each of the moments of the lesson (for example, introduction, autonomous work and whole-class discussion). Subsequently, the reflection is enriched with more specific contributions, such as notes about students' involvement and the task's impact on their learning, considering possible unexpected events, such as difficulties or unanticipated solutions. Thus, in this moment of post-lesson reflection, possible changes to the task and the lesson plan can be identified, as well as the development of teachers' knowledge. It was given these possible dimensions that a task about the perimeter of the circle (Figure 3)[4] and leading the students' work was the object of reflection by a group of teachers in a lesson study.

FIGURE 3

Task: Discovering π and the perimeter of the circle

1.1 Using a measuring tape, measure the perimeter and diameter of the base of some cylindrical objects and fill in the following table.

Object's name	Diameter (d)	Radius (r)	Perimeter (P)	P÷d
...	...	...	...	...

1.2 Compare the length of the radius and the length of the diameter. What can you conclude?

1.3 Compare the length of the perimeter and the length of the diameter. What can you conclude?

For this lesson, whose learning objective was to recognise the direct proportion relationship between the perimeter and the diameter of a circle and to designate by π the constant proportion, the column of the table that requested the quotient between the perimeter and the diameter had a fundamental purpose. However, the selection of these quotients for the moment of whole-class discussion needed greater attention, as reflected by Marta, the teacher who conducted this lesson:

[4] Task adapted from "*Direção Geral de Inovação e Desenvolvimento Curricular (DGIDC; 2009). Perímetros e áreas. Proposta de conjunto de tarefas para o 5.º ano – 2.º ciclo*".

> Marta: Amid so many objects, I could have selected one in each group... Then, to the end, I thought I would no longer have time to share everything, so each group went there [the board] to put an object's data. Maybe it shouldn't have been an object of their choice, but mine... I should choose the one that had the closest value to π.
> Helena: ... I noticed that, at least in these two groups, they chose to take to the table whole numbers [of the quotient], not values that involved decimal places.

The choice of the values of two groups to share in the whole-class discussion, referred to by Helena, reveals inaccuracies in the measurement, errors in the calculation of the quotients or difficulties of the students in working with decimal numbers. In the case of measurements with manipulative material, the measurement inaccuracies were anticipated during lesson planning. Still, it was in this moment of post-lesson reflection that the teachers, incited by Marta, reflected on the importance of selecting the quotients between the perimeter and the diameter closest to π to guide the students in identifying the regularity in this relationship.

When led to reflect on possible changes to the task or the lesson plan, the action of selecting the quotients before the whole-class discussion was again a focus of analysis:

> Paula: It was really interesting to try to understand who is being rigorous in the measurement.
> Diana: But that, perhaps, does not imply changing the task, but rather thinking about the discussion. They start [all] with the same object, for example, the roll of paper, and discuss before moving on to other [different] objects.
> Marta: And maybe right there, introduce some elements of the [symbolic] language.

This polyphony, marked by the interventions of several participating teachers, is one of the aspects of lesson study as a process of professional development. Although the lesson was led by Marta, a teacher who makes several interventions during the reflection and brings suggestions, the reflection is enriched by the participation of the other colleagues, either through the sharing of aspects observed in the students' mathematical activity or through future considerations to the task and its conduction. The collaborative recording of this polyphony during the post-lesson reflection also highlights the co-shared responsibility of all the work done during the lesson study sessions, even if it is only one of the teachers who leads the lesson. Thus, the development of students' knowledge and the way to lead the whole-class discussion, an important aspect of teaching practice, are issues that stand out from the post-lesson reflection for all the teachers who participated in this lesson study.

Teachers' perspectives on lesson study

At this point, we present reflections of participating teachers on the work done in lesson studies. Thus, regarding the improvement of tasks to achieve learning objectives, a teacher, Ana, in an interview, made the following reflection:

> I liked it, I liked that part ... Yes, the task is good, it's really good, but no [it's not yet good enough], we're always going to improve, improve, improve, that was very good... I think it made us think a little bit. Yes, I don't think I'll ever look at tasks the same way again. That's right... Of course, I think I need to improve a lot. Because this is all a matter of learning, it is in practice that we improve. I, as I said, have already applied some [tasks], but not in this way as it was done here, and this left me this taste, yes, it left me this taste because … I always heard my colleagues talk about the tasks and the work that can be done with the tasks, but I had never really done it.

The teacher shows that she understood that it is necessary to carefully consider the different aspects of the task, seeing how it can be adjusted to the learning objectives and characteristics of the students. She also considers that this work should be done in depth, with multiple revisions.

About the students' work in the proposed tasks, another teacher, Patricia, commented:

> They exceeded [my expectations]. They overcame. I wasn't expecting it, I'm being honest. I had never done this kind of activity with them, so they gave me a lesson, which was: "I am capable of doing more things than you think..." I was even ashamed of myself because, I thought, my God, they taught me a lesson. They said, "We've done things, or we're capable of doing things". Were they able to communicate mathematically? They were. Were they able to make connections? They were. Things I've never stimulated and... And that it is essential that we stimulate. That was a lesson for me that they gave me.

Patricia shows that she went from a view of the students as having many difficulties to another view in which she recognises in them the ability to devise productive strategies to solve questions with a significant degree of challenge. It also shows that she understood and valued the importance of transversal dimensions in mathematics learning, such as the ability to communicate and make mathematical connections. During her reflection, she also praised the contribution of having other teachers observe the research lesson in terms of understanding the students' mathematical activity:

> When I have, for example, a certain expectation of results and that doesn't happen, then I have to reformulate and see what happened to me or to them [students], see what's failing. Here, in lesson study, I not only did that because I was a participant in the lesson itself, but here, what changed was the feedback I got from all the observations you were recording of the students. Because when I'm in a lesson, even when they're solving exercises individually, there's a lot that I miss out and [here] I realised how this task had such a positive and motivating impact on students.

When conducting the general evaluation of their participation in the lesson study, the teachers emphasise several aspects, including the collaborative nature of the work. This is what Francisca highlighted:

> For me, it was very positive... Because... We worked together, we shared information... And the work between teachers is absolutely important. We often feel alone, don't we? ... I think that is the main issue. We opened up to each other. And we weren't afraid to... (because, sometimes, people are afraid to show their weaknesses) and I find sharing very productive, that is, working in a group... I think that's essential because sometimes we see that something will be difficult and [a solution can be found].

Another teacher, Dália, referred to aspects that have to do with the professional culture prevalent among teachers:

> This environment was created in which it was really very important to accept and reflect on the diversity of opinions because we do not always have the same opinion and are not always the students equal to reproduce the same model. It was really important the second reflection together, once again because these different opinions of both colleagues and the facilitator are pertinent because they often go towards, in my specific case, my weaknesses...

This teacher highlights important aspects in the way teachers can interact with each other, which is not always very productive, having difficulty accepting that there may be different perspectives and knowing how to use these differences for personal enrichment and for the benefit of group work, one aspect that is central in lesson study.

Potential and conditions

Lesson study, as a process of professional development, allows teachers to experience important learning, especially in the field of didactic knowledge (Ball et al., 2008; Ponte, 2012). We have analysed in this article some of these aspects, such as (i) the need to propose tasks that promote students' understanding of important aspects of curricular topics, (ii) the need to take into account relevant but often ignored learning objectives (such as the notion of reconstruction of the unit in the learning of rational numbers, the meaning of the constant π), (iii) the attention that is necessary to give to the prediction of the difficulties of the students and to find ways of acting to face them, (iv) the attention and appreciation of the strategies of the students, (v) the valorisation of the exploratory lesson in its various phases and, in particular, of the whole-class discussions, namely the importance of selecting to analyse wrong solutions with the whole class and to take advantage of comparing different solutions, and, also, (vi) the appreciation of collaboration and the construction of a professional culture based on joint work, exchange of ideas and reflection.

It should be borne in mind that lesson study, as a formative process, begins by provoking significant strangeness among teachers. This is natural, given that the lesson study is very different from the teacher education courses that teachers are used to attending and that often have as their main axis some theoretical problem or some very particular aspect of the practice (such as introducing new technologies in teaching). We can consider three strangenesses that stand out in teachers and correspond to particularities with great formative roles in the lesson study.

The first is the possibility that the presence of a large number of observers in the research lesson may disturb students, who teachers say may be distracted or behave in an exhibitionist manner. However, in the lesson studies that we carried out, this situation never occurred; on the contrary, there were classes with many students with behaviour problems in which the lessons ran without any incidents. The presence of the observers was even mentioned by many participating teachers as an advantage for collecting and understanding the students' mathematical activity, enriching the moment of further reflection.

The second strangeness of teachers is the time it will take to analyse students' learning of a single topic. Teachers are used to teaching education courses where many mathematical topics and their didactics are covered (in a necessarily very superficial way). The work proposed in a lesson study is very different – it seeks to analyse in great depth all the essential didactical aspects, and this, of course, is done around considering a single topic. This strangeness clearly highlights the notion that many teachers have that the didactical aspects do not require great deepening. However, at the end of the lesson study, teachers tend to recognise the value of attending to didactical issues that this work has provided them.

Finally, a third very common strangeness involves the observation of the lesson and its connection with teacher evaluation. Many teachers ask if the teacher who will lead the lesson is not evaluated by their peers and other observers. To this question, we answer that, in the research lesson, the focus is on the work and learning of the students. We also add that the lesson was prepared collectively, so it is the whole group's responsibility to point out the collaborative dimension of the process. In fact, after conducting and observing the lesson, there are important contributions from teachers who have played the role of observers but who would also like to be observed. These contributions are justified by the potential that they identify in their colleagues' observation regarding their students' knowledge and to enrich the reflection about their own practice.

The successful undertaking of a lesson study requires, of course, several conditions. First, the question of time arises. It is necessary that there are compatible schedules on the part of the participating teachers that enable the operation of the group and that the teachers are available to meet at these times. This condition is often difficult to satisfy, given the multiple roles that teachers assume in professional terms, to which are added the varied responsibilities of a personal nature. Second, teachers must be predisposed to invest in their professional development and to work collaboratively with other colleagues. This implies, in particular, the willingness to dialogue constructively, to observe and to be observed. Finally, there must be an effective leadership capacity in leading the lesson study, which can be carried out by a teacher educator or a school teacher with knowledge of the process and the ability to lead it.

Lesson study, a professional development process, can be combined with design research, a research design (Cobb et al., 2016). Both methodological approaches share the features of following a carefully designed process with an evaluation of results and cycles of improvement. However, there is a strong argument for the differentiation between both approaches, as design research requires a strong control of the researcher to be able to make assertions about the approach. In contrast, lesson study gives the participating teachers much control to increase the possibilities of agency and ownership, strengthening their

professional development.

Conclusion

The lesson study is carried out in a collaborative context, favouring the possibility of teachers learning from their practice or their colleagues' practice. It combines moments of structured work by the facilitator and exploratory work of the participating teachers and combines knowledge from research with the experiential knowledge of the participants. It is, therefore, a process of professional development capable of combining research and practice very closely, an aspect that has proved to be one of the most problematic in continuing and initial teacher education in Portugal.

In addition, the lesson study favours the development of the teachers' knowledge, especially with regard to its didactical aspects in terms of the teaching-learning process as a whole. These aspects often tend to be subordinated to partial approaches, which value one or another important didactical aspect or issue related to teaching contents or curricula but do not consider the teaching activity in all its aspects.

In this way, lesson study is a far-reaching formative possibility, with the potential especially to promote the professional development of teachers on issues related to student learning and teaching, but also to foster the development of a professional culture that values collaboration, reflection and research on practice.

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