

Professional Development of Professors in Lesson Study

Desenvolvimento Profissional de Professores Universitários em Lesson Study

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Abstract: The university professor's development has fostered research whose results evidence different approaches, such as the lesson study, a process centered on collaboration and reflection. This research was guided by the question: What collaborative dynamics characterize the participation-interaction of university professors (future teachers' educators) in lesson study? The investigation was conducted in a lesson study with university professors over twelve weekly meetings of two hours each. It involved eight professors from higher education institutions in the southern region of Brazil. The empirical material consists of the researcher's field notes and the transcripts of the recordings of the lesson study sessions and interviews conducted with the participants at the end of the process. The analysis showed three collaborative dynamics: communication, strengthened by the sharing and dialogue about teaching in undergraduate courses; planning, carried out in collaboration through the study of the guidelines for the education of future teachers and reflection on teaching in these courses; reflection-perspectivation that characterized the change of perspective on the contribution of learning in Calculus to the education of future mathematics teachers. The research points out that the lesson study enhances collaboration because it mobilizes different attributes of the teaching profession, such as basic knowledge of teaching, values and ways of performing university education, social and moral commitment to teaching, and teaching autonomy.

Keywords: Professional development; Teaching profession; Lesson study; Professional collaboration.

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Resumo: O desenvolvimento do professor universitário tem fomentado pesquisas, cujos resultados evidenciam abordagens diferenciadas, tais como o lesson study, processo centrado na colaboração e reflexão. A pesquisa orientou-se pela questão Quais dinâmicas colaborativas caracterizam a participação-interação de professores universitários (formadores de futuros professores) em lesson study? A investigação foi realizada em um lesson study com professores universitários ao longo de doze encontros semanais de duas horas cada. Envolveu oito professores de instituições de educação superior da região sul do Brasil. O material empírico constitui-se das notas de campo do pesquisador e das transcrições das gravações das sessões do lesson study e entrevista realizada aos participantes ao final do processo. A análise evidenciou três dinâmicas colaborativas: comunicação, fortalecida pela partilha e diálogo acerca da docência na licenciatura; planejamento, realizado em colaboração mediante o estudo das diretrizes da formação de futuros professores e reflexão sobre o ensino nesses cursos; reflexão-perspectivação que caracterizou a mudança de perspectiva sobre a contribuição das aprendizagens em Cálculo à formação dos futuros professores de Matemática. A investigação aponta que o lesson study potencializa a colaboração porque mobiliza distintos atributos da profissionalidade docente, tais como os conhecimentos basilares à docência, valores e modos de realizar o ensino universitário, compromisso social e moral da docência, a autonomia docente.

Palavras-chave: Desenvolvimento profissional; Profissionalidade docente; Lesson study; Colaboração profissional.

Introduction

Socially and historically, professions differ in nature, which is characterized by inherent knowledge and the establishment of their own practices, aligned with the necessary demands of a specific professional activity (CUNHA, 1998; BAZZO, 2007). For the authors, professionals from each area develop specific patterns of behaviors, ways of acting, skills, and dexterities that guide their professional activity. In addition, they appropriate values that materialize in attitudes and actions, which are relatively homogeneous in their professional field. Through this process, they appropriate the elements that guide and support their craft while developing knowledge and practices inherent in this activity (BAZZO, 2007). These elements constitute professionalism, that is, the set of attributes, socially constructed and legitimized, that allow distinguishing a profession from other professional activities (ROLDÃO, 2007).

Teaching, the act of teaching, is the main element that constitutes the professionalism of the teacher, a relatively stable conception over time in the face of changes of a different nature that transform societies (ROLDÃO, 2007). These aspects highlight the relevance of the discussion about the elements that constitute the teaching profession, since being a teacher is not a gift or vocation (ROLDÃO, 2007), it is a profession supported and legitimized by a complex body of specific knowledge necessary for teaching practices (RICHT; ALMEIDA, 2020).

The professional development of future teachers' educators assumes centrality, as it constitutes the process of developing new knowledge and practices, re-signifying and socializing already established knowledge and practices, and reflecting on their primary function: educating future generations of teachers. In its mission, the university professor develops, in addition to teaching, the production of knowledge from research, configuring the university as a community of knowledge (ROLDÃO, 2005; RICHIT, PONTE, RICHIT, 2022), as well as social intervention through extension and management actions. In this sense, Zabalza (2004) emphasizes that the university space is a privileged locus of education, and, therefore, professionals who dedicate themselves to this mission need to promote the development of their professionalism.

A formative approach that mobilizes different attributes of teacher professionalism, evidenced in research around the world, is the lesson study, which characterizes a collaborative and reflective professional development device centered on teaching practices (STIGLER, HIEBERT, 1999; LEWIS, 2002; MURATA, 2011; RICHIT, TOMKELSKI, 2020). In this, collaboration is conceived as an attribute of teacher professionalism, before which teachers constitute professional learning communities that seek to improve the teaching and learning of students.

From the perspective of contributing to the discussions on this theme, the research is dedicated to investigating the professional development of future teachers' educators, seeking to highlight and discuss the dynamics of collaboration between university professors participating in a lesson study, which involved professors from higher education institutions in the southern region of Brazil.

Teacher Professional Development

Teaching professional development involves fundamental principles, such as basic knowledge of teaching, professional learning throughout one's career, assimilation and modification of professional culture, changes in practice, and political and contextual conditions of teaching (RICHIT, 2020; 2021). Professional development characterizes the set of systematic efforts made to promote changes in teachers' practices in the classroom, in their attitudes and beliefs, and in the students' learning outcomes (GUSKEY; HUBERMAN, 1995; GUSKEY, 1997; FIORENTINI, 2013). This perspective involves constituent elements of school cultures (GUSKEY, 2002), such as how professionals relate to each other, how they perceive and interact in the professional context and make curricular and didactic decisions (DAY, 2001; RICHIT, PONTE and TOMKELSKI, 2020).

This perspective corroborates Hargreaves (1998), for whom teachers' professional cultures are based on human relations so that in any educational organization, there is a shared culture. For the author, a culture supported by relations "highlights what is owned and shared in common in human relations: values, habits, norms and beliefs, that is, the shared content of teachers' cultures" (HARGREAVES, 1998, p. 213). The deepening of Andy Hargreaves' concept of professional culture culminated in the characterization of four

types of teacher cultures: individualism, artificial collegiality, Balkanization, and collaboration, the latter being the focus of this article.

Professional collaboration, “understood as an ideal way to ensure the professional development of teachers throughout their careers, the learning of students par excellence and the transformation of schools into authentic learning communities” (LIMA, 2002, p. 7), is an emerging theme in scientific communities around the world. In collaborative contexts, teachers are encouraged to diversify teaching strategies, take risks, face changes, reflect on their own practice, achieving professional growth that provides them with educational change (HARGREAVES, 1998). Thus, collaboration is not the objective per se but rather a means to reach another goal, the teacher’s professional development. And this development is promoted, according to Hargreaves (1998, p. 209), “beyond personal and idiosyncratic reflection, or dependence on external experts, causing teachers to learn from each other, sharing and developing their skills together.”

From Hargreaves’ researches, different aspects related to collaboration have been investigated, developed, and systematized in the scientific communities of education, such as dialogue, sharing, negotiation, group work, cooperation, mutual help, and other principles, such as overcoming hierarchies and humility.

The elements that characterize the culture of collaboration – how teachers relate, considering the permeabilizing intersubjectivities of these relationships, the values, practices, knowledge, and ways of acting – constitute elements of teaching professionalism, which is marked by some idiosyncrasies in the face of the particularities of the context and the subjects who interact with it. This perspective is presented by Antonio Viñao Frago, according to which professional cultures influence the teaching profession, understood in constant elaboration and must be analyzed within a historical context in which social relations end (D’ÁVILA; LEAL, 2015). Professionalism refers to what is most specific in each profession, permeated by elements of professional cultures, and is historically constituted from the ability, skills, and values that are incorporated and materialized in professional practices.

Teacher professionalism is the inseparable relationship between knowledge, skills, values, attitudes, and ways of acting typical of the professional practice shared by the members of an educational institution or educational network (HOYLE, 1980). The Hoylean perspective broadened the concept of professionalism, adding elements from social and professional relationships established between the members of a teaching community, which are marked by elements of the professional cultures shared in this group and by the specificities and intentionality of teaching. Therefore, the teaching profession does not only refer to the structuring elements of the act of teaching. It also circumscribes the values, beliefs, attitudes, intentions, and moral and ethical commitment in the exercise of teaching.

Therefore, the development of the university professor's professionalism presupposes the concretization of the relationship between theory and practice (ZABALZA, 2004), the complementarity between different domains of knowledge and their structuring dimensions – teaching, research, and extension (CUNHA, 1998). Ergo, the university professor’s professionalism in undergraduate courses encompasses the conceptual and practical domain of teaching (ROLDÃO, 2007) related to basic and higher education, the involvement and commitment of tutors to the education of future generations of teaching

professionals, as well as the domain and conditions for scientific development (production of research and knowledge) in the areas in which they operate.

Lesson Study as a Teacher Development Process

Lesson study, a professional development approach focused on collaboration and reflection (LEWIS, 2002; MURATA, 2011; RICHIT, PONTE and RICHIT, 2022), involves small groups of teachers who work collaboratively around four main stages: identifying a learning problem and formulating objectives for student learning; preparatory work and planning a class for a class of students (the research lesson); teaching this class with observation by a team of teachers and/or researchers; and reflection on the aspects observed by the team about student learning (PONTE et al., 2016; RICHIT and PONTE, 2017; PINA NEVES, FIORENTINI and SILVA, 2022). During the process, teachers collaboratively and reflexively articulate theory and practice and, from that, constitute new attributes of teaching professionalism (RICHIT, 2021) in mathematics education.

A basic principle of the lesson study is collaboration, which has been increasingly investigated by researchers from different countries (LEWIS et al., 2009; BURROUGHS and LÜEBECK, 2010; INOUE, 2011; LEAVY, 2015; HARGREAVES, O'CONNOR, 2018; RICHIT and PONTE, 2017; RICHIT, PONTE, and TOMASI, 2021), whose research results have shown that this approach allows participants to carry out collaborative work and experiment with a new practice.

The lesson study enables teachers to develop collaborative work by sharing objectives, discussing ideas, and jointly developing teaching resources in their professional practices (BURROUGHS and LUEBECK, 2010). According to Ponte et al. (2016), the lesson study, due to its dynamic collaboration, constitutes a context that favors communication between participants and reflection on professional practice. Likewise, collaborative planning, focusing on students' learning objectives on specific curricular topics, allows teachers to value this dimension of teaching, as it constitutes a space to situate very specific demands of teaching in specific contexts (leafy, 2015). This approach also allows participants to overcome the professional individualism prevalent in teachers' daily lives and promote opportunities to experience collaborative forms of professional learning (WAKE, SWAN, and FOSTER, 2016; RICHIT and TOMKELSKI, 2020).

Collaboration between teachers and researchers is an important aspect highlighted in the researches of Miyakawa and Wisłøw (2009), Ponte et al. (2016), Hargreaves and O'Connor (2018), and Richit, Ponte, and Tomkelski (2020). This form of collaboration favors the overcoming of professional hierarchies (RICHIT, 2020), the multiplicity of roles (LEWIS et al., 2009), and shared leadership (HARGREAVES; O'CONNOR, 2018), promoting the involvement and contribution to a common enterprise in a logic of valuing the experience and knowledge of all participants (PONTE et al., 2016). In addition, collaboration in a lesson study provides a context to enable inclusive practices in higher education, involving the stages of planning, execution, and evaluation of the process (OLIVEIRA et al., 2021). In turn, the aspects mentioned contribute

to clarifying differences between approaches due to shared experiences and objectives (MIYAKAWA; WISLØW, 2009). Therefore, lesson study provides opportunities for changes in the professional practice of those involved in relation to the objectives and intentions for the teaching of the curricular topics studied, the strategies and resources developed in this process, and also the ways of planning professional practice through collaboration.

Thus, the change in practice and education, as suggested by Hargreaves (1998), Guskey (2001), and Lewis et al. (2009), presupposes the constitution of professional learning communities (PINA NEVES, FIORENTINI, and SILVA, 2022) permeated by negotiation, dialogue, sharing, reflection, and humility, in which all participants focus on understanding and improving the learning teaching processes. Lesson study, by involving teachers with different levels of professional experience in collaborative planning, in the observation of practice and subsequent reflection, constitutes a professional development approach that mobilizes and develops different aspects of teaching professionalism.

Methodology

Nature and objectives of the investigation. The research takes the qualitative perspective (DENZIN; LINCOLN, 2000) as a way to emphasize the eminently social nature of the professional development of future teachers' educators, examining it in the light of different meanings and values that this process assumes for lesson study participants and how they establish their professionalism. Qualitative research welcomes the objective of highlighting and discussing the dynamics of collaboration among university professors participating in a lesson study, assigning meaning to the dialogues and interactions promoted in this process, and representing these meanings in the light of the theoretical assumptions of teaching professionalism. The research unfolds into two specific objectives: (I) to identify aspects of a professional culture that influences the professional development of the university professor in a lesson study; and (II) to highlight and understand the possibilities of realization of professional collaboration, conceived as a culture favorable to the growth of the professor.

Research Context. The investigation took place in a lesson study conducted from May to August 2021, organized in twelve sessions of approximately 2 hours each, which involved eight university professors (Alice, Amy, Catarina, Christopher, Esther, Estrela, Michel, and Tatiana – fictitious names), professors at universities in the three states of the southern region of Brazil, and a mathematics degree student (Natan – fictitious name). The lesson study cycle, planned within the scope of an interinstitutional research project, was carried out remotely due to the wide geographical distances between universities.

The lesson study was structured in four stages – definition of objectives for the research lesson, planning, teaching, and post-lesson reflection. The virtual sessions were recorded in the Webex system and transcribed, constituting the empirical material of the research.

Due to the pandemic, the research lesson was conducted remotely in a Mathematics Degree course class at the Federal Institute of Santa Catarina – IFC, Concórdia Campus, within the scope of the Calculus

subject. The class, held and recorded in a virtual video conference room Google Meet, was voluntarily taught by Amy, the Calculus teacher that year, and observed by the other participants in the lesson study.

Formation and analysis of data. The empirical material consists of the researcher's field notes and the transcripts of the recordings of the sessions. The field notes were produced after each session, seeking to highlight the different actions, interactions, and reflections of the participants that are mobilizers of professional collaboration. The investigation is in line with the ethical research criteria and was approved by the Research Ethics Committee (Opinion n. 4.764.981, approved on June 10, 2021), prioritizing preserving the identity and integrity of the participants.

The qualitative and interpretative analysis (ERICKSON, 1986) established as reference units the set of excerpts that revealed elements that characterized the dynamics of collaboration. Then, from the reference units, the registration units were defined, and, finally, the categories of analysis, which were named as follows: communication, planning, and reflection-perspectivation.

Results

The qualitative and interpretative analysis (ERICKSON, 1986) showed that the lesson study allowed teachers to realize collaborative dynamics from three perspectives: communication, planning, and reflection-perspective.

Communication. The structure of the lesson study and the interactions that were established allowed the participants to establish and strengthen the *sharing of experiences and expectations* about the education of future teachers and the challenges of the university professor, especially in undergraduate courses.

Regarding the challenges of educating future mathematics teachers, leading them to appropriate mathematics knowledge and how to teach it, the participants highlighted that this is a fragile aspect in universities, since the curricular reforms implemented in recent decades have gradually reduced the structure of mathematics, opening spaces for components that have become necessary in the face of the demands of contemporary education

I see that in recent years, undergraduate curriculum programs have been increasingly incorporating new components, especially teaching practices. And although I consider that practices are fundamental in the formation of the future mathematics teacher, I have observed that these changes decrease the time of mathematics itself, which is also essential (Amy, Field Notes, 5th session).

Participants *share the understanding* that these new components are necessary for the education of future teachers; however, they consider that mathematical training needs to be well developed.

The *sharing of readings and professional and academic experiences* was an aspect that stood out in this lesson study cycle. Since the first meeting, the sharing of readings (articles, books) was spontaneously consolidated in the communication between the participants so that some suggestions were incorporated into the lesson study planning. Other readings were socialized and compared in the context of the discussions

held in the planning stage, and others were shared by the communication devices used by the group (Whatsapp; Google Drive, and Classroom).

Academic experiences were highly valued in the group, also instituting themselves spontaneously in the process. Before starting the activities of each planning session, in the space dedicated to general reports and general sharing, the practice of reporting the events and activities that had taken part in that week was spontaneously instituted, highlighting the impressions, the contributions to the growth of each one or their research, the issues that approached the discussions promoted in our cycle, the various concepts intrinsic to the development of the lesson study – such as the concepts of task, investigation and exploration task, exploratory approach, collaboration and reflection concept –, and controversial issues related to the lesson study, such as its nature: Is lesson study an approach or a teacher education methodology? Is it a professional learning community? The discussion around this last issue was very productive.

Dialogue with colleagues about lesson study, about what lesson study is, led me to recognize myself as a participant in a learning/practice community, in which each one, with their actions, contributes to the construction of knowledge collectively (**Amy**, Field Notes, 7th session).

The *sharing of academic achievements* was also established in the group through the socialization of articles published by participants, approved projects, and attended events.

Guys, I want to share with you a personal achievement, which is the publication of an article in a journal. That is a huge accomplishment. The article deals with some issues that I have studied [...] (**Michel**, transcript, June 2021).

The *socialization of events* to be held and other academic activities also emerged in the group, as suggested in the excerpt below.

Hey, you all, in November of this year, the conference of WALs [World Association of Lesson Study] will be held. It's a lesson study-only event, and it's a very important one. This edition, due to the pandemic, will be virtual. I think it is very important for us to participate even because it will be virtual. Submission of papers is open. And I think we could send an essay because this lesson study that we're doing is different, it's new. We could write a collaborative abstract and submit it. Or even more than an abstract. [...]. I will see the guidelines on the event website and send them to our WhatsApp group (**Catarina**, Field Notes of the 8th session, July/2021)

These shares enhanced other forms of collaboration to the extent that participants were encouraged to participate in events, including by submitting collaborative works. In this specific example of WALs, participants organized and prepared two works for the event, which were accepted and presented. This aspect characterized a new form of sharing within the scope of our lesson study editions and was valued by the participants

Sharing has always been enriching. Throughout the development of LS, we had moments with exchanges of knowledge. They were not just about the theoretical framework of the LS. All these moments contributed to the formation in different ways. Many teachers participating in the project and engaged in higher education indicated events and activities in which they participated, for example. Some of them participated in LS-related events and brought some of what they had learned, presented or read (**Natan**, Participant Logbook, July/2021).

Accordingly, sharing fostered collaboration at a different level, which consists of *collaborative academic writing*, and enhancing present and future academic partnerships, an aspect inherent to the professionalism of the university professor (research and knowledge production).

Consequently, the mechanisms of dialogue, negotiation, sharing, and encouragement enhanced communication in the group, promoting collaboration at different actions and levels. And through collaboration, the participants mobilized aspects of teaching professionalism in undergraduate courses, such as knowledge, skills, values, and intentions related to the education of future mathematics teachers and, especially, on the achievement of this mission at the intersection of two dimensions of higher education (teaching and research).

Planning, centered on the research lesson, constituted a peculiar dynamic of collaboration, as we moved from our roles as educators of future teachers and became partners in a professional learning community, occupying ourselves with discussing our role and our commitment to the future mathematics teachers' education.

We are conducting a lesson study. So, we teachers are experiencing this lesson study process. So, I think we will be able to study two things: our process, our learning, our training, and also how students will react to this task [this class we are planning] and how to work with this task (**Esther**, transcript 9th session, July/2021).

When confronting the research question posed at the beginning of the process, the teachers questioned how the lesson study could contribute to explaining aspects related to the role of Calculus, specifically the topic addressed in the lesson study, in the education of the future mathematics teacher.

Because I see this guiding question precisely as guiding. [...] Something like we thought of doing with the lesson study, not to answer this question specifically, but thinking before that, let's say, about the education of these prospective math teachers. We chose calculus, the concepts of maxima and minima, which are important concepts for the structure of the future teacher. So [...] I think we can try to search for these data points with students, for example, with the interview (**Michel**, transcript 9th session, July/2021).

The planning lessons favored the shared reflection on the (im)possibility of answering the research question, mobilizing aspects related to the dimensions of initial teacher education, such as Mathematics and how to teach it.

By carrying out collaborative planning, we produce more than one class: we produce understandings of what planning is, what we want to achieve with this planning, and all the elements involved in this process. I hope this group will remain, as I miss having a group to think about these issues and also to study, to discuss concepts, theories, and research results (**Alice**, Field Notes, June/2021).

The planning promoted collaboration to the extent that they were able to elaborate a lesson plan based on the study of the curriculum guidelines related to the training of future teachers (BNC – formação) [(BNC – development)] and research results centered on a lesson study in higher education. Likewise, it allowed them to reflect on the nature of this activity (planning), the challenges of teaching Calculus in Mathematics Degree courses, and the learning difficulties of students in this component. Additionally, it favored the discussion on other aspects that influence teaching from the perspective of lesson study, such as school culture, which in some circumstances imposes some guidelines on the process.

We have to think that the country's culture, the country's school culture [brings some difficulties to this approach]. In Japan, for them, it is very common for teachers to observe each other's classes. [...]. They don't see it as an invasion of my space, like someone is watching me. No! It's just a cultural thing. And it really is something very difficult to deal with. So, one thing that draws my attention is the balancing that the facilitator, the mediator of the class lesson study needs to have to deal with situations like this and not want to impose their will, but really try to add to the group. So [lesson study] is very challenging! (**Catarina**, transcript 8th session, July 2021)

In summary, planning was characterized as an important dynamic of collaboration in lesson study with future teachers' educators, to the extent that it elevated the group as a learning community, mobilizing aspects of teacher professionalism related to the knowledge, resources, and strategies necessary to carry out the 'Maximum and Minimum' approach and, especially, on the issue to be deepened in the lesson study cycle. At the same time, it led them to discuss aspects that guide the implementation of a lesson study in contexts such as Brazil, where the classroom (and the teaching that occurs in it) is still considered a private space, isolated from the external eye.

Reflection-perspectivation, which characterized perspective expansion on the contribution of learning in Calculus to the future mathematics teachers' education, stood out as a dynamic of collaboration through a movement of reflection on the mission of the educator of future teachers in the face of the implementation of the National Common Framework for Teacher Development (BNC – development) [Base Nacional Comum para Formação de Professores (BNC – formação)], approved in December 2019, whose guidelines impose new challenges to teaching.

Such collaborative dynamic was also evidenced in the context of the discussion on the research question, which had been defined at the beginning of the lesson study cycle

[Because of] what we have already entered, deepened [...] this implies a broader look. [Thinking about the development of the future teacher implies] looking at the future teacher. What implications do we have, both conceptual and formative, to look at the future teacher? And [what are] our formative implications, as employees, trainers, in short, the team that is thinking about [this process]? So, that's what it seems to me, a broader process. And then, as Esther said, a more punctual process of the lesson

study itself [...], which then is much more explicit about the issue of the curricular component (**Estrela**, 9th session, July/2021).

It also emerged as part of the reflections on the role of the Calculus component in the education of future mathematics teachers and the emerging challenges in their teaching. Participants valued the constitution of a community to think about these issues, socialize and rethink interventions, conceptions, and practices.

For me, this group, which was constituted by the lesson study, is more than a lesson study cycle. This group constitutes a space in which we can place ourselves as learners. It is a space in which we can reflect among peers on the future mathematics teachers' education and on the challenges that this mission brings us. The changes in curriculum guidelines pose many challenges to our practice that lead me to ask whether the teaching I do in Calculus or Algebra is actually contributing to educating future mathematics teachers. I hope this group will remain, as I miss having a group to think about these issues and also to study, to discuss concepts, theories, and research results (**Amy**, Field Notes, June/2021).

In summary, the dynamics of collaboration achieved in the lesson study mobilized different aspects of the professionalism of future mathematics teachers' educator, such as professional and academic collaboration in the face of teaching and research, commitment to its mission of educating future teachers, knowledge, skills, and skills related to teaching in higher education and, above all, the relationship between theory and practice. And these aspects, in turn, favored the participants' professional development.

Discussion

A basic principle of the lesson study is collaboration, a theme investigated by researchers from different countries (LEWIS et al., 2009; BURROUGHS and LUEBECK, 2010; INOUE, 2011; LEAVY, 2015; RICHIT and PONTE, 2017; HARGREAVES and O'CONNOR, 2018; RICHIT and PONTE, 2019; RICHIT, PONTE and TOMASI, 2021; OLIVEIRA et al., 2021), which characterizes a way to promote the professional development of teachers, student learning, and transforming schools into learning communities (LIMA, 2002). Through this perspective, the lesson study enhances the university as a space for teacher growth (ZABALZA, 2004) insofar as it constitutes learning communities that bring together professionals from different areas and who assume different roles, especially that of educating future generations of teachers. In these learning communities, elements of teaching professionalism are developed and valued.

The results of research on collaboration in lesson study have pointed out that this approach allows participants to carry out professional activity in collaboration, experiment with a new practice, assume the risks arising from this change (HARGREAVES, 1998), carry out professional learning, and develop attributes of teaching professionalism. These contributions can be enhanced through the realization of collaboration at different perspectives and levels (RICHIT, PONTE, and TOMKELSKI, 2020) to the extent that different collaboration dynamics are established and fostered.

Regarding the lesson study with university professors, the analysis pointed out that professional collaboration was achieved through three main dynamics – communication, planning, and reflection-perspectivation –, fueled by sharing, mutual listening, dialogue, encouragement, and mutual support, negotiation, shared leadership, and welcoming.

Communication. Lesson study promoted collaborative work based on sharing objectives and experiences, discussing ideas, developing materials and resources for the research lesson (BURROUGHS and LUEBECK, 2010; PONTE et al., 2016, RICHIT and PONTE, 2017), stimulating dialogue, negotiating decisions and sharing responsibility. And these aspects were strengthened by welcoming participants at a higher level and by valuing individual and collective voices through mutual listening. Additionally, sharing fostered collaboration at a different level by expanding to academic writing, and enhancing present and future academic partnerships, an aspect inherent to university professors' professionalism (research and knowledge production).

Therefore, the lesson study carried out with future teachers' educators allowed participants to reflect on their professional mission (to train future generations of mathematics teachers), implement sharing of a different nature, and respect mutual listening, enhancing communication between all. And communication became a device for effective collaboration on new levels, favoring professional and friendly relationships. Thus, communication, as a dynamic of collaboration, mobilizes and develops aspects of the professionalism of the educator of future teachers, contributing to their professional development.

The planning carried out around research lesson, focused on students' learning objectives on the 'Maximum and Minimum' curricular topic and the study of curriculum guidelines and research results (PONTE et al., 2016; RICHIT and PONTE, 2020), favoring the relationship between theory and practice (CUNHA, 1998) and educational changes (GUSKEY, 2001) through the approximation of the conceptual and practical dimensions of teaching (ROLDÃO, 2007) in mathematics degree courses.

The realization of the outline of the collaborative research lesson allowed teachers to value this dimension of teaching, as it constitutes a space to situate very specific demands of teaching in also specific contexts (LEAVY, 2015), namely those related to the education of future generations of mathematics teachers and the challenges arising from the implementation of recent curricular guidelines for the education of future teachers in Brazil.

The planning experienced in a lesson study, by promoting collaboration between teachers and researchers (MIYAKAWA and WISLØW, 2009; PONTE et al., 2016; HARGREAVES and O'CONNOR, 2018; RICHIT, PONTE and TOMKELSKI, 2020), favors overcoming professional hierarchies (RICHIT, 2021; 2020) and the multiplicity of roles (LEWIS, et al., 2009). The lesson study with future teachers' educators inaugurated collaboration between teachers-researchers of similar but distinct university realities in their geographical, social, and cultural specificities, favoring responsibility and shared leadership (HARGREAVES; O'CONNOR, 2018).

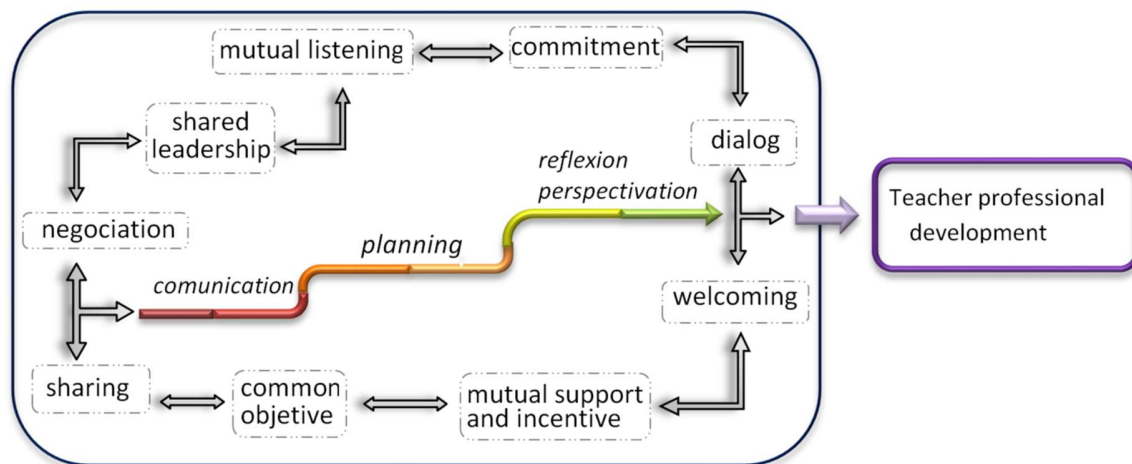
Ergo, planning is a central collaboration dynamic in a lesson study, as it provides a learning community for those involved, evoking different domains of knowledge and structuring dimensions of the university professor's professionalism (CUNHA, 1998; BAZZO, 2007; ALMEIDA and RICHIT, 2020).

Reflection-perspectivation. The lesson study allowed participants to reflect on the possibilities of overcoming the professional individualism prevalent in the teacher's daily life, as well as promoting opportunities to experience collaborative forms of professional learning (RICHIT, PONTE, and TOMKELSKI, 2020; PINA NEVES, FIORENTINI, and SILVA, 2022). The reflection on lesson study (LEWIS, 2002; MURATA, 2011; RICHIT, PONTE, 2019; RICHIT, 2020) was extended in this cycle to the extent that the participants valued the constitution of a community to think about the mission of the future teachers' educator in the face of recent educational changes, to socialize experiences and rethink professional conceptions and practices.

Lesson study's reflection, expanded through the observation and analysis of life in the classroom (LEWIS et al., 2009), allowed participants to develop a perspective on the contribution of Calculus learning to the education of future mathematics teachers. Thus, reflection-perspectivation proved to be an important dynamic of collaboration to the extent that the reflections carried out in a shared perspective (RICHIT, PONTE, and TOMASI, 2021) led them to review professional beliefs, conceptions, dispositions, and attitudes (DAY, 2001; RICHIT and PONTE, 2019) related to the education of future generations of teaching professionals.

The model presented below explains the dynamics of collaboration in the analyzed lesson study, fed by the basic principles of collaboration (dialogue, sharing, mutual support and encouragement, negotiation, shared leadership, commitment, mutual listening, and welcoming) that empowered the group as a professional learning community, promoting the academic and professional development of all.

Collaboration dynamics in lesson study



Fonte: RICHIT (2021)

In summary, the dynamics of collaboration concretized in a lesson study promote the professional development of the future teachers' educator because they mobilize different attributes of teaching

professionalism (RICHT, 2021), such as basic knowledge of teaching, values, and ways of performing university teaching, teaching commitment in undergraduate courses, approximation between theory and practice, and teaching autonomy.

Conclusions

The dynamics of lesson study allowed participants to review and deepen professional knowledge, carry out professional learning of a different nature, experience a new practice, and, especially, break with professional cultures that guide the teacher's growth through collaborative experiences. In the analyzed experience, the collaboration, supported by communication, planning, and reflection-perspectivation, mobilized different aspects of the professionalism of the university professor, especially the educator of future teachers, promoting the professional development of the participants (BURROUGHS and LUEBECK, 2010, CUNHA, 1998).

From this process, the professor of undergraduate courses develops new knowledge, practices and values, re-signifies and socializes established knowledge and practices, and reflects on their primary function: to educate future generations of teachers. In their mission, the university professor develops, in addition to teaching, the production of knowledge from research, as well as social intervention through extension and management actions.

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