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Contributions of Lesson Study to the reconstruction of teachers' practical knowledge within a virtual setting context. Case study at Universidad Nacional de Educación (Ecuador)

Víctor Sumba Arévalo[1]
Patricia Pérez Morales[2]
Natalia Fátima Sgreccia[3]
Encarnación Soto Gómez[4]

Summary

Purpose – This article examines the training of nine practising teachers and the development of their practical thinking through Lesson Study (LS) at Universidad Nacional de Educación (UNAE). The study therefore aims to describe and understand how this group of teachers might reconstruct their practical knowledge while engaging in the LS experience in a virtual setting.

Design/methodology/approach – A case study was conducted with (virtual) field immersion, qualitatively collecting and analysing data through observations, interviews, a focus group and written outputs.

Findings – Reconstructions and reinforcements were evident in each of the five dimensions of practical thinking (Soto et al., 2019; Pérez-Gómez, 2022) and in certain knowledge and values, in addition to various skills, attitudes and emotions. The main findings of the study relate to the importance of planning to avoid improvisation, viewing the teaching methodology as a flexible process, developing student autonomy, understanding and managing technological and digital tools, and being prepared for uncertain situations.

Originality/value – It is understood that Lesson Study is a strategy that strengthens and enhances understanding of teachers' knowledge, even in the virtual context, and should therefore be considered for the ongoing professional development of teachers in Ecuador.

[1] Universidad Nacional de Educación UNAE
[2] Universidad Nacional de Educación UNAE
[3] Universidad Nacional de Rosario
[4] Universidad de Málaga

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Introduction

According to research by Restrepo and Stefhos (2018), Ecuador has 9012 teachers (5.50%) who are high school graduates, and 18,039 (11%) who have completed technical or technological studies, out of a total of 163,999 people working in the teaching profession, with the Amazon Region having the highest number of teachers with these qualifications. These figures highlight the need for teacher training aimed at improving student learning. This need is further reinforced by Transitory Provision Fourteen of the Intercultural Education Act, which states:

> High school graduates who are practising teachers must complete level-three, technical or technological studies in Education Sciences by 31st December 2020 in order to secure their permanent appointment in Category G, otherwise their provisional appointment will be terminated. (Intercultural Education Act, 2017, p. 80)

It is in this context that Universidad Nacional de Educación (UNAE), under an agreement initially signed with the Ministry of Education (MinEduc) and subsequently with the Technical Secretariat of the Amazon Special Territorial District (STCTEA), implements the plan for the professionalisation of teachers through Basic Education and Intercultural Bilingual Education (distance learning format). This plan is exclusively for teachers who have not completed level-three (degree) studies, i.e. high school graduates or educational technologists with a minimum of five years of experience. In this regard, the UNAE (a flagship public university established in 2013 and dedicated solely to teacher training) acknowledges the experience of these teachers by officially recognising four training cycles of the teaching degree, allowing them to directly enter the fifth cycle when the training spans a total of eight cycles over four years.

The UNAE, through its institutional pedagogical model, also emphasises the significance of reflection, research and practice, among other aspects. This pedagogical model incorporates Lesson Study (LS) as the core element in all teacher training programmes at the university. Specifically, in distance learning programmes, it is part of the eighth training cycle, where it is analysed theoretically through the subject *"Lesson Study: Networks of Cooperative Teacher Support"* and practically through the subject *"Interdisciplinary Studies: Design of Intervention and Educational Research Proposals in Basic Education."*

It is in this context that the doctoral research entitled *"Teacher Training: Lesson Study's Contributions to the Professionalisation of Teachers. Case Study at Universidad Nacional de*

Educación" accompanies nine practising and trainee teachers to demonstrate how applying and discussing LS can transform and improve their teaching practice.

Due to the COVID-19 pandemic, the virtual environment became the unexpected setting for both researching and training participating teachers at UNAE, as well as a synchronous meeting space for teachers and students. This context provided a new scenario for research and practice, in order to identify and understand the knowledge, values, skills, attitudes and emotions that teachers mobilise in their virtual classroom work (Sumba, 2023). In the Ecuadorian context, as we will see below, this study highlights a training model for practising teachers that promotes the reconstruction of practical knowledge, even in a virtual setting.

Lesson Study as a strategy for research and teacher training

The interrelation between research and educational action has led to the recognition of teachers as researchers (Stenhouse, 1998) or reflective professionals (Schön, 1998), representing another crucial dimension of their role. This is particularly important in Ecuador, where there is an emphasis on thorough investigation of the teaching process rather than relying on automatic understanding. This research process "allows teachers to construct knowledge by solving problems encountered in their practice" (Ramos, 2013, p. 27).

There are many studies supporting the contribution of LS as a strategy that integrates research, innovation and improvement of learning for both students and teachers (Soto-Gómez and Pérez-Gómez, 2015; Dudley, 2015; Wood and Cajler, 2019; Helgevold and Wilkins, 2019; Estrella and Olfos, 2023).

LS is a collaborative, cyclical action-research where a group of teachers designs, observes and reflects on a lesson or lessons (class sessions) in order to identify strengths and weaknesses, and, in turn, informs their decisions to improve the next intervention (del Río, 2021; Soto et al., 2019). Peña (2012) states that one of the key strengths of LS is the opening up of the classroom to the group of teachers, serving as the core element in constructing and/or reconstructing professional knowledge (Soto et al., 2019) by directly and systematically observing in order to collect and analyse evidence of students' learning throughout the teaching process they have designed.

LS is therefore based on the classic phases of action-research: identify the problem, topic or goal; develop a strategic plan; collect evidence of the results; critically reflect (Escudero, 1987, as cited in Latorre, 1992) by incorporating peer cooperation and improving the initial design based on the following core elements: 1) Define the problem; 2) Cooperatively design an "experimental lesson" and its study; 3) Teach and observe the lesson; 4) Collect evidence and discuss; 5)

Analyse and review the lesson; 6) Develop a revised lesson in another class and observe it again; 7) Discuss, assess and reflect on new evidence and disseminate the experience. (Soto-Gómez and Pérez-Gómez, 2015; Vásquez, 2017).

Ultimately, LS offers a "system for teaching to learn and learning to teach, i.e. a structure that promotes the development of professional teaching competencies by incorporating a set of practices, mental habits, interpersonal relationships, structures and tools" for analysis of the curriculum through collaborative and comparative work where theory and practice nourish teachers' professional development.

In this regard, LS, as a form of action-research enhanced by its cooperative nature, is particularly significant as it allows teachers to recognise the educational potential of their actions through collaborative reflection in and on action (Perrenoud, 2007; Schön, 1992). In other words, this process of reflection on student learning makes *practical knowledge* or *knowledge-in-action* (which defines and supports teaching practice) visible (Pérez-Gómez et al., 2015). Practical knowledge consists of dimensions (knowledge, beliefs, skills, attitudes, values and emotions) that operate and influence the teacher's role unconsciously and automatically when perceiving, interpreting, making decisions and acting in the classroom: "A fast, automatic, useful and effective processing and response system, but epistemologically laden with prejudices, gaps and contradictions as resulting from each individual's biographical experience in the context surrounding their existence" (Soto-Gómez et al., 2021).

Comparing and incorporating the improvement of the lesson designed in another context, systematised by the LS, makes practical knowledge visible; it analyses educational potential in light of the most refined theoretical knowledge, and ultimately favours the reconstruction or development of *practical thinking* —a thinking that necessarily incorporates this practical knowledge, but filtered through reflection and comparative theoretical information, since:

> It consists of all the resources (conscious and unconscious) that humans use when trying to understand, design and intervene in a specific situation in personal or professional life. It involves a variety of cognitive and affective resources that develop gradually and thoughtfully, taking into account all possible variables for analysing phenomena and situations, as well as anticipating the consequences of different courses of action individuals can take in their environment. (Soto-Gómez et al., 2021, p.7)

The cyclical, systematic nature of LS favours the reconstruction of habits that constitute practical knowledge, enabling unconscious and automatic action informed by a rigorous process of reflecting on and reconstructing primitive ideas. In other words, practical knowledge –made explicit and conscious through the lived and contrasted process– transforms into practical

thinking, understood as knowledge-in-action plus reflective knowledge about the action that leads to more conscious and informed thinking and decision-making (Pérez et al., 2015).

Therefore, this reconstruction of practical knowledge or development of practical thinking in teachers requires what Hagger and McIntyre (2006) and Pérez-Gómez et al. (2015) call *theorisation of practice*, i.e. a process that "re-recognises and understands the explicit and implicit resources that constitute, nourish and condition us in relation to the deepest core of our beliefs and their complex identity within a living context of experience" (Soto-Gómez et al., 2021, p.8) and *experimentation of theory*, where rigorously tested and discussed knowledge transforms into practical, sustainable, adaptable methods of interpretation and action.

The different phases of a complete LS cycle reveal teachers' knowledge, beliefs and dispositions, which undergo collaborative analyses in order to adopt new conscious, informed stances that underpin their practice –a process that undoubtedly takes time and repeated efforts.

Practised for over a century in Asia, LS has gained traction in the US since the late 20th century and in Europe and Latin America since the early 21st century, emerging as an alternative strategy for enhancing educational practices and teacher training (Soto-Gómez and Pérez-Gómez, 2015). This approach creates an ideal context for not only exchanging theoretical knowledge, but also addressing often overlooked dimensions in teacher training, such as skills, attitudes, values and emotions, ultimately influencing teaching practices.

According to Soto and Pérez-Gómez (2015), the focus of LS is not only on what students learn, but also on how they learn and respond to the questions, resources and strategies used or proposed by the teacher in class. This aspect is especially relevant to our research, given the virtual teaching and learning context during the COVID-19 pandemic, allowing us to explore the opportunities and limitations of applying LS in this setting and to see how teachers' practice adapts to this new reality (Goei et al., 2021). It therefore requires reflection and a deep understanding of what it means to teach today in the digital context.

In summary, LS is key to systematically and integrally demonstrating and modifying practical knowledge, transforming its dimensions from unconscious, automatic and implicit to conscious, reflective, contrasted and explicit, with these being core elements of a teacher-researcher's practical thinking (Soto-Gómez and Pérez-Gómez, 2015), and especially relevant in addressing the educational challenges of an increasingly uncertain and changing society.

Methodology

The research was developed under the qualitative approach through a case study (Flick, 2015; Stake, 2007; Denzin and Lincoln, 2013) based on theoretical and purposive sampling

(Martínez-Salgado, 2012) at UNAE, part of the Basic Education distance learning programme for the professionalisation of practising teachers who were in the process of obtaining their bachelor's degree. The case was chosen based on the following criteria: 1) The UNAE, as a flagship university, was set up to bolster teacher training and the educational system in Ecuador, being a benchmark in terms of its pedagogical and research model; 2) The UNAE's interest, via an agreement with the Ministry of Education and the STCTEA, in offering distance learning courses (called professionalisation) for practising teachers; 3) The university curriculum highlights the importance of practical thinking, practice and theoretical analysis in investigating, understanding and improving teaching activity; 4) The curriculum draws on the Lesson Study subject to respond to the aforementioned components; 5) The phases are developed in the Interdisciplinary Studies subject and, for this research, in the teachers' own classrooms, i.e. in real teaching and learning scenarios.

The conditions were therefore in place to investigate *how these LS processes may or may not transform practical knowledge and consequently develop the practical thinking of the groups of teachers.* The case involved nine practising teachers (D1 to D9), who were university students enrolled in the eighth and final cycle of their degree programme, in the subjects Lesson Study and Interdisciplinary Studies. In the first subject, the theoretical-methodological approach of LS was taught; in the second, the process was experimented with by each group of teachers. Developing the LS and conducting field research took nine months, from July 2020 to March 2021, after which the data were analysed in order to compile the report. Teachers were recruited based on pre-established criteria, as detailed in Table 1. These 9 teachers were divided into three groups (G1LS, G2LS and G3LS) of three members each.

Recruitment criteria
1. Be enrolled in the Basic Distance Education programme.
2. Be enrolled in the eighth cycle.
3. Be enrolled in the Interdisciplinary Studies subject.
4. Work in the province of Cañar at General Basic Education level.
5. Agree to voluntary participation in the research.

Table 1: *Recruitment criteria for participating teachers*

Both the training cycle at UNAE and the research were conducted virtually due to the COVID-19 pandemic. This unexpected situation obviously opened a new field of experimentation and research, adding a new nuance to the research question: What reconstructions of practical knowledge are observed in teachers when they engage in the LS experience in a virtual environment? The virtual immersion was conducted under the guidance of the Interdisciplinary

Studies teacher, with support from the first author of this article. Authorisation was requested from the university's directors to access the virtual classrooms, and the LS phases were developed through synchronous *Zoom* meetings.

Data were collected through the following sources: observations of the LS phases developed (Phases 1, 2, 3, 4, 5, 6, and 7); individual interviews at three points: initial (IntervI), intermediate (IntervIt) and final (IntervF); however, teachers D3 and D6 did not participate in IntervIt, while teacher D2 did not participate in IntervF. An inter-group discussion group (DiscGroup) is presented in detail in Table 2, along with all the written and other outputs presented (Activ1.6, 2.2, 3.3, 3.4 and PIENSA [Integrative Knowledge Project that concludes the training process and involves the systematisation of the LS experience, in this case one per group]). The data collected were triangulated to ensure validity and rigour in the research process (Cisterna, 2005; Okuda and Gómez-Restrepo, 2005), allowing us to discover and identify strengths and weaknesses in the development of practical thinking among the teachers involved in the training experience.

Technique	Time period/Source	Teacher	Nomination	Total
Interview	Initial (2020) Intermediate (2020) Final (2021)	D1 to D9	IntervI-D1- D9 IntervIt-D1- D9 (no D3 and D6) IntervF-D1- D9 (no D2)	24 interviews 688 minutes
Documentary analysis: Interdisciplinary Studies activities	2020 Systematisation of the experience: Activ1.6; Activ2.2; Activ3.3; Activ3.4; PIENSA	G1LS G2LS G3LS	Activ1.6…-G1LS	15 documents
Observation	2020-2021 Phases of the LS observed (F3-F4-F5-F6-F7)	G1LS G2LS G3LS	ObservF3…-G1LS	15 recordings 708 minutes
Discussion group (inter group)	2021 Close the LS	D1 to D9	DiscGroup-D1…	1 recording 108 minutes

Table 2: *Techniques used for data recording*

For data processing, *Atlas.ti* version 23 was used to store and analyse transcripts of interviews, observations, focus groups, teachers' written outputs, and videos of the lessons. The information was coded using prior categories and subcategories, such as practical knowledge,

practical thinking, teacher reflection, collaborative work, theorisation of practice and experimentation of theory. From these categories, practice was observed within the framework of LS, identifying situations that led to the determination of six emerging categories around "the curriculum", "planning", "methodological strategies", "student's role", "virtual environment" and "complex reality".

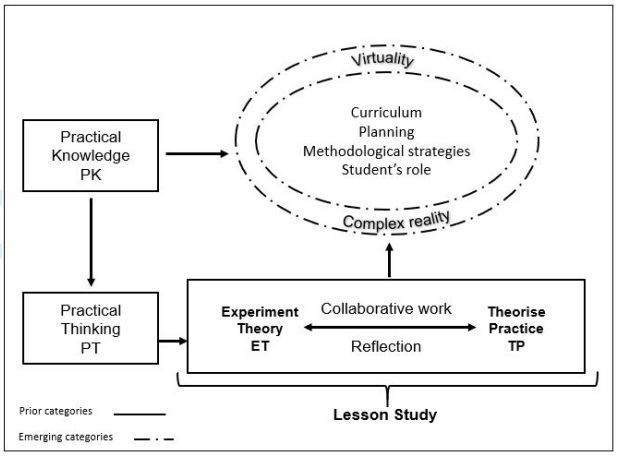

Figure 1. *Relationship map of categories and subcategories*

The figure above shows the relationship between the prior and emerging subcategories. We began with basic prior categories for our research, namely a description of practical knowledge (PK) and the potential reconstructions, or practical thinking (PT), of teachers related to the focus of the LS, analysing the processes of theorisation of practice (TP) and experimentation of theory (ET) that may have influenced these developments, all based on the reflective, collaborative processes promoted by LS. This posed a significant challenge for Ecuador's individualistic teaching culture.

In developing the LS, especially in its initial phases, manifestations related to dimensions of practical knowledge emerged around knowledge, beliefs and skills, such as the curriculum, planning, methodological strategies and the student's role, all inevitably linked to the axiological and emotional dimensions. The complexity of the unforeseen virtual environment raised some concern and uncertainty (as seen in Figure 1).

Therefore, given the observation framework and the open, flexible analysis based on empirical evidence, triangulation and data contrast, a deductive and inductive process was developed to understand the reconstruction of teachers' practical knowledge in this research using the data recorded in each phase of the LS.

Discussion of results

The participating teachers are practising educators who, due to socio-economic conditions, geographical location, training processes or other factors, do not have a bachelor's degree. However, they were allowed to teach without a degree until 2020 due to the high demand for teachers in the country. This group of teachers started studying for a bachelor's degree in basic education in 2017, at the beginning of the professionalisation programme. They all work in elementary schools, which is the setting for this research. The teachers developed the LS phases in the Interdisciplinary Studies subject, in which they followed up on the progress of this research.

The immersion of the nine teachers in the LS experience provided a space to observe, inquire and reflect on their own practice. From the initial phase (Interv1; Activ1.6), the teachers demonstrated aspects of their practical knowledge that were questioned during the collaborative experimentation, facilitating the reconstruction of this knowledge (ObservF6, EntrevF, ObservF7 and DiscGroup).

Figure 2 provides a synthesis of the core elements describing their initial practical knowledge and the processes and conceptualisations that were questioned, opening new paths for the development of their practical thinking. These core elements underpin the presentation of the main findings and discussions of this research.

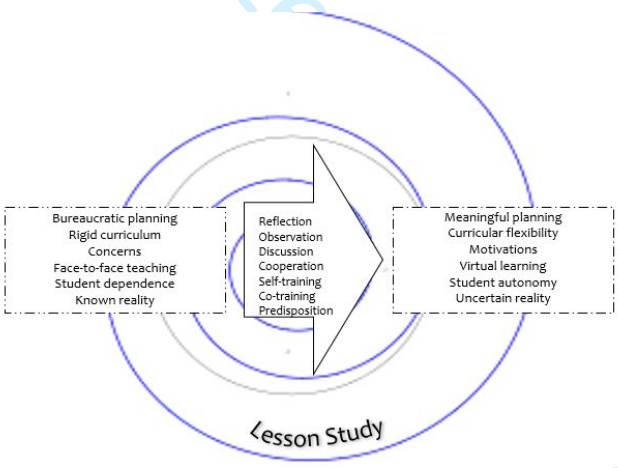

Figure 2. *Core elements of reconstruction of knowledge in practical thinking*

From bureaucratic to meaningful planning

In this section, one of the changes identified in the groups was related to perception around planning or designing the class. At the beginning of the experience, teachers D2, D3, D4, D5, D6 and D8 (IntervI, 2020) already valued this activity; however, other teachers, such as D1, D7, D9 (IntervI, 2020), saw it merely as an administrative task to comply with institutional authorities' requests, exemplified by "To me, it is just something we have to do for presentation

purposes" (IntervI-D7, 2020). This view changed after participating collaboratively in the design, observation and redesign phases of the lesson (Ponte, 2017). Here, they began to recognise it as a crucial opportunity to discuss and agree on the most effective activities and resources:

> We also researched, as my colleague mentioned, other methods and techniques that we weren't familiar with in order to better reach the children, as teaching virtually is more challenging. This meant we had to look for many alternatives to reach them. (DiscGroup-D7, 2021)
>
> After observing the first class, we were motivated to plan or revise certain activities because we noticed that, in some areas, the pupils did not respond as we had hoped, and we did not see clear evidence of learning on the topic with the initially planned activities. So, in agreement with the group, we modified and added more activities to help the children better grasp the topic that was covered in that lesson plan. (DiscGroup-D9, 2021)

In the case of G2LS, the intermittent Internet connection during the synchronous meeting prevented teacher D4 from sharing the activity designed in *Genially*. Faced with this situation, teacher D5 intervened to pose new exercises that were solved (orally) (ObservF3-G2LS, 2020). It is worth noting that the teachers placed importance on planning; however, according to their statements and considering the virtual context, they found it necessary to anticipate some emerging situations and have "an ace up their sleeve" (ObservF4-D5, 2020), which is why they designed additional activities. In this situation, the cooperative work also became explicit, as an observing teacher (D5) intervened in unexpected situations to help the teacher in charge (D4) develop the lesson.

This relates to what Schön (1992) calls "surprise and reflection in action", which generally goes unnoticed by both the teacher and the researcher, as it triggers a response in the teacher that "changes the script" in the face of an unexpected situation. This action favoured the reconstruction of teachers' practical knowledge, as they proposed additional activities to respond to eventualities in the improved lesson design, offering an example of reflection in and on action (Schön, 1998) or theorisation of practice (Hagger and McIntyre, 2006). For teachers, planning became a way to anticipate unexpected actions in the virtual environment and be prepared for eventualities; hence, they embraced the idea of "having an ace up their sleeve," which did not mean "improvisation" but rather planned tasks to be applied at the right moment in order to consolidate learning (D4-DiscGroup4, 2021). In line with this, Peña and Pérez-Gómez (2019, p. 572) believe that "reflection-in-action consists of asking about what is happening or going to happen, what we can do, what needs to be done, what the best tactic is, which guidelines to follow and precautions to take, what risks there are, etc."

From the rigid curriculum to curricular flexibilisation

LS was also the space to demonstrate the coherence between espoused theories and theories-in-use and some reconstructions related to ***what***, ***how*** and ***why*** of teaching. As for ***what***, teaching practice in this research centred on the subject of Mathematics. This gained significance in relation to why we teach, stemming from the teachers' belief that it is "fundamental to life". This firmly held belief was consistently reinforced in practice throughout the research (Activ2.2-G1LS, 2020; ObservF7-G1LS, 2021; ObservF7-G3LS, 2021; IntervF-D4, 2021). This is how some teachers put it: "it is an indispensable part of our life. And we are going to need it to solve problems in our daily lives" (IntervF-D1, 2021). "It is very important for us to introduce and cultivate Mathematics in the early years of education, as this helps pupils develop an appreciation for it and overcome any fear they may have towards the subject in later years." (DiscGroup-D3, 2021).

This belief was expressed by teacher D1 when developing the class, quizzing pupils about the importance of the subject: the teacher asks, 'Why is it important for us to know how to add?' After a short period of silence, one of the pupils' answers: '*to go to the store to buy*'; (another child) 'so they don't steal our change' (ObservF6-G1LS, 2020). This evinces the coherence between their beliefs and their classroom practice, i.e. the explanation given by the teachers in this research about what they think or believe, and how this relates to what they actually do (Argyris, 2008, as cited in Christensen, 2008).

As for the ***how*** of the curriculum, teaching revolved around constructive proposals that encourage dialogue (López and Toro, 2008). The teachers clearly articulated the method to be used in the knowledge construction process. G1LS and G2LS (PIENSA, 2020) chose the Problem-Based Learning (PBL) methodology and the phases of Mathematics (tangible, graphical, symbolic), the latter being a means of transition from the tangible to the abstract, prompting the experimentation and verification of relevant algorithms in problem-solving. Meanwhile, G3LS (PIENSA, 2020) opted for the "Singing and writing the numbers" method. It should be remembered that the transition to a virtual education setting introduced a new context for applying this methodology, leading to new challenges for teachers, despite their prior face-to-face experience. As for PBL, teacher D1 said:

> We used to implement it through face-to-face methods; however, transitioning to a virtual format now presents some challenges. We need a little more research in order to understand its usefulness, benefits and, most importantly, how to develop this methodology virtually. (IntervIt, 2020)

Teacher D4 (IntervIt, 2020) also recounted her experience: “I applied the PBL methodology in the area of Natural Sciences, and, when working face-to-face, engaged directly with the research question and the problem, working in collaborative groups from then on.” As for G3LS, teacher D9 said: “I have done it a lot: (in the anticipation stage) we always start from a song, from a dynamic, which, if it has a positive impact, means we can observe changes in the children’s motivation” (IntervIt2, 2020).

In this regard, it was found that the teachers had prior knowledge of this methodology, prompting them to consider it in the new format. The virtual setting presented challenges around developing the teaching and learning process in terms of transitioning from usual face-to-face practices to virtual experimentation. Teachers therefore need to explore, develop, experiment, and discuss the teaching processes established in the classroom to apply them in the virtual world (Sumba et al., 2022, p. 258). Here, reconstructions were evident in terms of the dimension of knowledge and skills related to the ***how*** of the curriculum. For example, in G1LS, reconstruction among the teachers is evident in the socialisation of the problem-solving process. The first lesson involved work with specific materials (Cuisenaire rods); they then moved on to the graphic and symbolic phases, where Teacher D1 (ObservF3, 2020) omitted pupils’ participation in socialising the problem-solving process, an important step in PBL (Restrepo, 2005). Although this activity was included in the planning, it was not carried out. Teacher D1 attributed this to difficulties with the virtual format, so she did it in an expository manner: “it was very difficult for me because I was not trained in using the digital whiteboard, so we came up with this way of doing it” (ObservF4, 2020).

Meanwhile, in the second lesson, teacher D3 (ObservF6, 2020), considering the redesigned lesson and the group discussion, particularly the suggestion made by teacher D1: “we are going to ask a boy or girl to explain how it could be solved, if they have understood the procedure” (ObservF4-D1, 2020), allocated time for the children to orally reconstruct the developed process. Understanding how to observe colleagues’ practice (lesson development phase) is therefore crucial, providing a space to analyse the teaching and learning process (in this case related), opening the way to reconstruct the habits that constitute their professional knowledge.

G2LS also had an explicit intention to, from discourse, work with PBL and the Mathematics phases (PIENSA, 2020); however, during the first lesson, the process was not evident despite the lesson design being more dynamic:

> Teacher D4 presents a problem involving charts for a pupil’s birthday. He only manages to solve it mentally, without engaging in a process of analysing the problem, proposing

alternatives, or applying the phases of Mathematics. Moreover, after finding the answers, he tells pupils to work with tokens. The problem is solved immediately, so teacher D4 decides to pose other addition problems. (ObservF3, 2020)

When the facilitator-researcher commented on the decision to propose new exercises that were not in the lesson design (Activ2.2., 2020), the reflections of teachers D4 and D5 emerged, strengthening the idea of curricular flexibility: “planning should not be rigid or restrictive. We can adapt each moment in line with needs, but, if we have proposed something similar, that doesn’t mean we have stepped outside the parameters.” (ObservF4, 2020, p. 3). Meanwhile, in relation to the phases of Mathematics (which went undeveloped, despite being originally included in the lesson design), they drew on their own and colleagues’ experiences to advocate for gradual application, highlighting the impact of personal beliefs and peer opinions on teaching practices (Vásquez, 2017).

> We have always been told something that I try to keep in mind: that, at an early age, they must be given time to be taught and guided. Whether it takes one, two or three days, it doesn’t matter, but we must apply the phases in a way that pupils can understand. If children today apply addition only in a tangible manner, tomorrow we will be able to use it in both the tangible and symbolic phases. (ObservF4-D5, 2020)

Another point worthy of note in G1LS and G2LS, who implemented PBL as their approach, is recognising this methodology as a flexible process that can be adapted to the specific needs and situations teachers encounter. This relates to Rocha (2020), who cautioned that virtual processes should not mimic face-to-face settings, but rather require adaptation through active methodologies suitable for the new scenario. In this research, this aspect related to students’ beliefs in adapting the processes according to age. “We do not apply it strictly as the methodology states, but rather as a flexible methodology according to the pupil’s age” (ObservF5-D5, 2020).

> We selected specific steps from PBL because we were concerned that, given the children’s young age, it might not work well and we wouldn’t achieve our goal. However, in this redesign we were mindful of this and began implementing additional steps because we had seen previously that progress could indeed be made (ObservF7-D3, 2020).

This adaptation was observed in practice (ObservF3 and F4- G1LS, 2020; ObservF3 and F4-G2LS, 2020) and in:

1) Problem-solving using picture symbols. “The goal of the class was also communicated clearly and simply, using vocabulary suitable for the children’s age.” (Activ3.3-G1LS, 2020);

2) Problem posing and socialisation by pupils during the process (ObservF6-G1LS, 2020);

3) Implementing the phases of Mathematics (ObservF6- G1LS, 2020; ObservF6-G2LS, 2020); and

4) Using digital resources; among others.

This experience validated PBL as a methodology in which to construct one's own learning in virtual environments (ObservF7-D1, 2020) through self-learning, analysis and reflection (PIENSA-G1LS, 2020). Collaborative reflection (discussion phase) was particularly important as it provided a space for teachers to analyse their actions.

This experience showed how LS, even in a virtual environment, created a space to make practical knowledge visible and transform it. This was particularly relevant in designing novel learning processes, where teachers were accustomed to face-to-face practice. The new scenario, now aligned with their concerns, succeeded in making new practices visible, and in mobilising and managing them.

From face-to-face to e-learning

When developing this research, the teachers' classes took place in a virtual setting during the first months of the confinement caused by the COVID-19 pandemic. In this scenario, there was obviously a shift from face-to-face to virtual practice. Initially, the case study teachers voiced concerns about developing teaching and learning that required them to adapt technological and digital resources in line with needs, limitations and interests. In relation to that observed in the LS, several elements or manifestations were considered that implied transformations in practical knowledge, while other aspects were reinforced. Applications were used for synchronous meetings, such as the *Zoom* and *Teams* platforms.

The digital resources helped develop the lessons by allowing inquiry, planning and implementation. Teachers stated that the purpose of these resources *(Genially, Kahoot, PowerPoint)* was to stimulate pupils' interest in the class. In this regard, the reconstruction of skills, attitudes and knowledge was identified by proposing more engaging activities; for example, in the knowledge consolidation phase (ObservF3 and F4-G1LS, 2020), it went from being a vertical sum of numbers (first lesson design) to an interactive (pre-designed) digital activity (redesign and development phase of the new lesson).

This virtual teaching experience facilitated the search for new resources, adaptation of didactic processes, observation of other teachers and collaborative work, among others. All these actions provided learning opportunities and sparked interest in learning in order to reinforce the teaching role; for example, teacher D3 (ObservF4, 2020) noted use of the digital whiteboard (lesson development phase) by Teacher D1 (ObservF3-G1LS, 2020) and wished to learn: "I am

going to ask D1 to show me, because sometimes you can learn a great deal from colleagues." This serves as evidence that reinforcing predisposition to learn from peers is crucial, thus "direct observation in the classroom by teachers remains a key element in stimulating methodological change and enhancing student learning" (Soto-Gómez and Pérez-Gómez, 2015, p. 17). This virtual experience also demonstrated that, while an individualistic approach based on the teacher as the "owner of the classroom" (Sumba, 2023) may "work well" in face-to-face settings, here there is a need to foster collaborative work for effective support and learning. The groups therefore reinforced the value of collaborative work (a characteristic of LS) as an opportunity to discuss, reflect and learn among colleagues. This creates opportunities to forge a cooperative culture (among teachers) with a view to reinforcing practice. An example of this was mentioned by teacher D5:

> Working collaboratively with other teachers also allowed us to open our minds to see the mistakes we were making and to overcome them. In many of face-to-face classes, it often feels like we're locked inside our own classroom bubble, with nobody to tell us what's right or wrong. However, this collaborative approach means that colleagues can point out our weaknesses, helping us to overcome challenges and to rethink and reapply our strategies. (DiscGroup, 2021)

This not only demonstrated their reconstruction of the concept, but also their ability to foster motivation in virtual spaces, contrary to their initial belief that this was exclusive to face-to-face interactions: "for me, the most important thing is to work with the child in person, to be attentive to them, to motivate them, to accompany them, to feel what affection is" (IntervI-D3, 2020). By the end of the LS experience, teacher D3 had changed her opinion.

> Yes, it has been possible to stimulate motivation in pupils; not only can we do it in person, but also virtually. We look for thousands of ways: games… anything; at home... have them interact with family members and motivate them by seeking out their best moment, so that the rest of the class, the rest of our future learning, will be happy and done in the best way possible. (IntervF, 2021)

Teachers' motivation in this research was related to emotions and attitudes such as joy, calmness, willingness to work and security. This influenced teachers to create an enabling environment for pupils through their attitudes, actions and expressions, considering the "role of the teacher as a facilitator of contexts and environments that invite students to develop competencies" (Peña and Pérez-Gómez, 2019, p. 581). The practice of the teachers who developed the class (ObservF3 and F4-D1, D3, D4, D5 and D9, 2020) was therefore marked by situations that revealed a series of emotions.

From dependence to autonomy

The virtual format changed the initial belief that pupils are not independent, i.e. that they need help because they are young: “they still do not have autonomy, they do not have the ability to manage on their own. So, if the parent does not support them, it is very difficult for them to make progress” (D3 - IntervI, 2020). During the lessons, it was noticeable that there were suggestions for actions to promote independent thinking and action, as was evident when teachers asked to solve mathematical problems with available materials (ObservF6-G2LS, 2020). This reconstruction could be seen in the following class activities:

> Teacher D3, by suggesting posing the problem with the presented data, makes it clear that it is the pupil who must structure the problem, literally stating: you cannot ask your mum or dad to think for you, but you can make notes because maybe you can’t understand all the phonemes, or you can write it down with some graphics (ObservF6-G1LS, 2020).

From reflection-on-action (discussion phase), teacher D3, who developed the second lesson, identified that “the pupils were doing things quickly, so I went step by step, little by little, stopping to help them, so that they could solve things, so that they could do things. But yes, they were more agile and achieved it easily” (ObservF7, 2020). Moreover, teacher D1 believed that autonomy had been achieved, but only among those who attended the synchronous sessions (IntervF, 2021).

Similarly, they reinforced the value of the family (Sumba, 2022), both for maintaining interaction and participation during synchronous sessions (ObservF7-D5, 2021) and as an important form of support for development. In the words of teacher D9, “the role of the parent or legal guardian is a very important factor with this new format; they are currently practically fulfilling both roles, as teachers and as parents” (ObservF7, 2020). The MinEduc proposal, “We learn together at home” (2020), therefore directly involved the family.

However, the role of the family was also questioned by the case teachers in two circumstances. The first circumstance refers to the lack of support and accountability for asynchronous learning tasks (ObservF5- D3, 2020; D7- IntervF, 2021). They also felt that the family was an occasional distraction in synchronous sessions (G1LS-Activ3.4, 2020). Secondly, although the family provided support, teachers noticed that they were giving children the answers, preventing them from generating their own ideas: “it’s harmful because it doesn’t allow them to concentrate, to come up with their own ideas” (ObservF4- D5, 2020). This led to uncertainty as the level of learning could not be accurately assessed (IntervF-D4, 2021).

From known reality to uncertain reality

Even before the LS, the teachers recognised that the world is constantly changing (attitude of predisposition); after its conclusion, this recognition remained, but was now enhanced by the experience of interacting with and addressing the uncertain, evolving virtual reality within the ever-changing contexts of time, space and schools (Gonfiantini, 2013). In addition, for teacher D1, predisposition to learning implied getting involved in research processes: “there is still a great need to continue exploring, to continue researching, especially around managing technology, the tools, the resources that we now require” (IntervIt, 2020).

This perception of a changing reality indicated the need to transform education, suggesting that teachers should not only teach but also encourage pupils to discover and acquire knowledge themselves (IntervIt-D4, 2020). This statement challenged teacher D4’s belief, rooted in his school experience, that the teacher alone was responsible for pupils’ education. The opinion of teacher D5 (IntervF, 2021, p. 2) was also identified: “teachers’ work is challenging because we must be ready to change any situation that comes our way. In this regard, I don’t hold back; I go with whatever comes up.”

Ultimately, the results demonstrate how the LS experience improved the visibility and contrast of practical knowledge, facilitating reconstructions in core aspects through continuous joint reflection before, during and after the action (theorisation of practice). These reflections, theories and maps were therefore applied in practice in order to address real, complex, evolving needs, demonstrating informed practical knowledge or practical thinking.

Particularly worthy of mention are the challenges that this research entailed. For example, during the discussion groups, teachers were expected to participate fluently by sharing, analysing and discussing the different points observed. This was not easy in the virtual context and required the intervention of the researcher in order to stimulate the discussion with questions. Another challenging aspect of conducting research virtually was data collection, as the observed reality was limited to what was shown on the screen, creating a somewhat decontextualised or newly contextualised scenario. It was therefore necessary to rely on the teachers’ experience to complement the data. The virtual environment has undoubtedly created a new scenario, demonstrating the need for exploration whenever teacher practice is developed there.

Conclusions

In conclusion, the experience of teachers in the LS, even in the virtual setting, was that of a space for self-observation and observing others, for mutual reflection, for building knowledge with peers and learning, and for unlearning and relearning aspects that enhance teaching practice. This experience “leads to the understanding that cooperation requires empathy,

commitment, companionship, dialogue, common goals and more, in order to overcome isolation and professional selfishness" (Sumba and Mejía, 2021, p. 57). In this evolution, LS is a novel, enriching alternative to consider as a strategy for the training and cooperative action-research of teachers in Ecuador's education system. The results of this unique research could help develop a permanent training model based on LS for our country, offering practising teachers the opportunity to actively engage in reconstructing their knowledge, skills, attitudes, values and emotions (Sumba, 2023).

It is important to remember that teachers' practice develops in a complex, ever-changing environment, making it necessary to engage in action-research and peer education processes in order to build and reconstruct their own practice, knowledge and emotions. Thinking and rethinking ongoing teacher training from LS "differs from traditional training programmes or training which, while addressing general problems, do not necessarily address the specific issues that teachers face in the classroom" (Sumba, 2022, p. 15).

The reconstruction of practical knowledge (into practical thinking) is possible and requires an investigative process that involves the teacher as the central figure in their own practice, helping them to uncover and understand trends, logics, practices and discourses that guide their teaching activity. The virtual environment revealed the unconscious dimensions of practical knowledge, such as beliefs, skills, attitudes, values and emotions, consolidated from face-to-face and routine practice, which were not useful in this new context and required collaborative work and constant reflection with other teachers who shared the same contexts and circumstances.

The virtual format demonstrated the emergence of collaboration in lesson development, where it is necessary for all teachers to be prepared to respond to unexpected situations; here, the lesson observer becomes the lesson executor and vice versa, all with the aim of ensuring student learning and maintaining class flow. It also revealed the need for virtual environment teachers to have additional activities as "an ace up their sleeve" when planning lessons, ensuring they are ready to respond to unforeseen situations.

This research sheds light on understandings and contributions that inform teachers' practice around LS. It therefore demonstrates the importance of rethinking the strategy for continuous training and action research with and by teachers, especially in the Ecuadorian context. Moreover, it is imperative to contemplate and elucidate the processes and characteristics of LS that contribute to such reconstruction, with the intention of incorporating them into training procedures.

Future lines of work would include ensuring further research on the development of LS in virtual contexts to diversify experiences and demonstrate the reconstruction of practical

knowledge, investigating the practical knowledge of teachers returning to classroom teaching, and designing a continuous training model based on LS in Ecuador, given the opportunities it offers for improving teaching practice and training.

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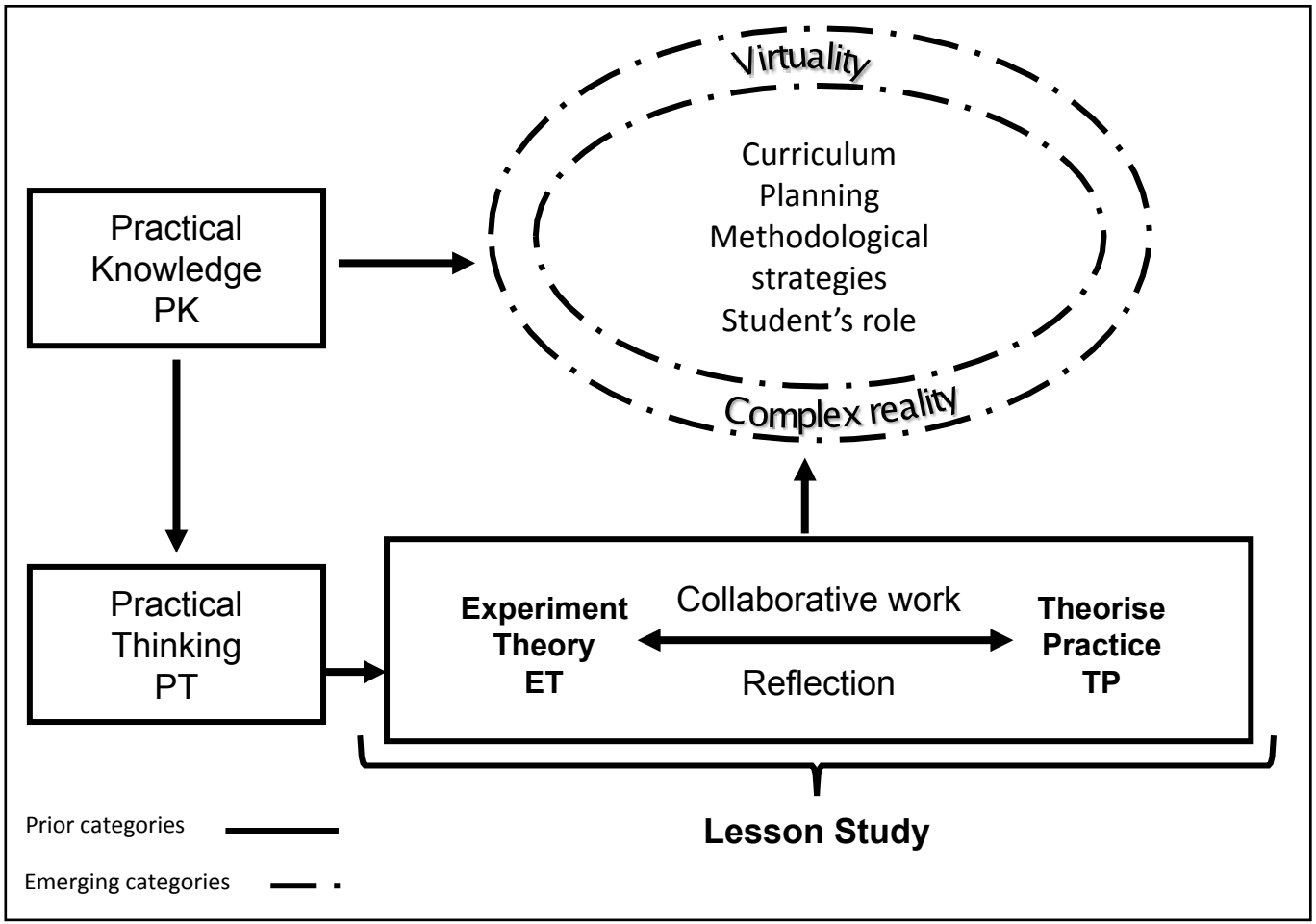

Figure 1. *Relationship map of categories and subcategories*

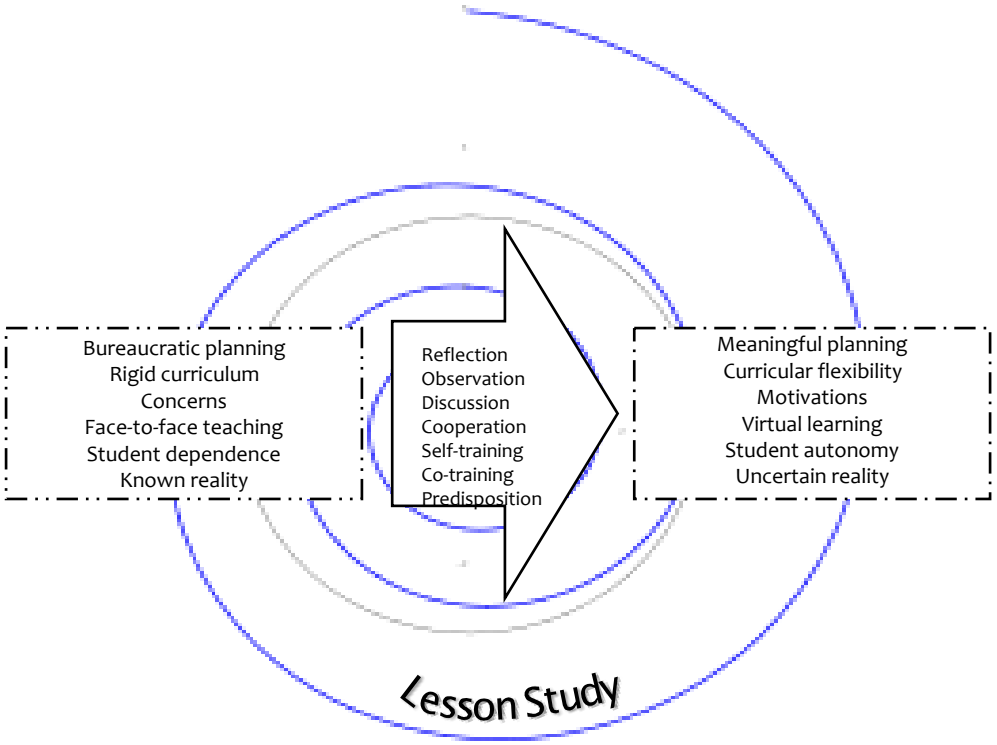

Figure 2. *Core areas of reconstruction of knowledge in practical thinking*