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Professional training to teach statistics in early childhood education[1]

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ABSTRACT

This article analyzes the professional learning of two early childhood education teachers during their training to teach Statistics. The training occurred remotely due to the COVID-19 pandemic and was provided by the Early Childhood Education Coordination of the municipality of Itabuna, Bahia, Brazil, representing the University-School Leadership (USL), in partnership with Rede Educação Matemática Nordeste (Northeast Mathematics Education Network). Teaching sequences were prepared based on the investigative methodology PPDAC (Problem, Plan, Data, Analysis and Conclusion). Two teachers were interviewed and the transcripts of these interviews were analyzed using the Discourse Textual Analysis methodology. Results showed the following three dimensions of professional teaching development: specific knowledge, professional learning and changes in practice. Moreover, professional learning refers to reviewing practices for teaching statistical concepts, reflecting on the professional practice, collectively built collaboration, teacher engagement and commitment and USL efforts to develop professional learning training strategies.

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KEYWORDS: Professional development. Professional learning. Early childhood education. Statistical concepts.

O Desenvolvimento profissional docente no ensino da Estatística na Educação Infantil

RESUMO

O artigo objetiva analisar as aprendizagens profissionais de duas professoras da Educação Infantil que participaram de um processo formativo com foco no ensino de Estatística. O Processo formativo aconteceu remotamente, devido à pandemia da COVID-19 e foi realizado pela Coordenação de Ensino da Educação Infantil do Município de Itabuna, representando a Liderança Universidade Escola (LUE), em parceria com a Rede Educação Matemática Nordeste. Foram elaboradas sequências de ensino baseadas na metodologia investigativa PPDAC (Problema, Planejamento, Dados, Análise e Conclusão). Duas professoras foram entrevistadas, as transcrições foram analisadas com Análise Textual Discursiva. Os resultados, apontam três dimensões do Desenvolvimento Profissional Docente: conhecimentos específicos, aprendizagens profissionais e mudanças na prática. As aprendizagens profissionais se referem a: rever práticas para o ensino de conceitos estatísticos; reflexão sobre a prática profissional; processo colaborativo construído na coletividade; engajamento e compromisso do professor; articulação da LUE para o desenvolvimento de estratégias formativas de aprendizagens profissionais.

PALAVRAS-CHAVE: Desenvolvimento profissional. Aprendizagem profissional. Educação Infantil. Conceitos estatísticos.

Desarrollo profesional docente en la enseñanza de la Estadística en Educación Infantil

RESUMEN

El artículo tiene como objetivo analizar el aprendizaje profesional de docentes de Primera Infancia que participaron de un proceso de formación centrado en la enseñanza de la estadística. El proceso de formación se realizó a distancia, debido a la pandemia de la COVID-19, y fue realizado por la Coordinación de Enseñanza de Educación Infantil del Municipio del

Sur de Bahía, en representación de la Escuela Universitaria de Liderazgo (LUE), en alianza con la Red de Educación Matemática del Nordeste. Las secuencias didácticas fueron elaboradas con base en la metodología investigativa PPDAC (Problema, Planificación, Datos, Análisis y Conclusión). Se entrevistó a dos docentes, las transcripciones se analizaron con Análisis Textual Discursivo. Los resultados indican tres dimensiones del Desarrollo Profesional Docente: conocimientos específicos, aprendizaje profesional y cambios en la práctica. El aprendizaje profesional se refiere a: revisar prácticas para enseñar conceptos estadísticos; reflexión sobre la práctica profesional; proceso colaborativo construido en la comunidad; participación y compromiso de los docentes; articulación de la LUE para el desarrollo de estrategias de formación para el aprendizaje profesional.

PALABRAS CLAVE: Desarrollo profesional. Aprendizaje profesional. Formación contínua. Conceptos estadísticos.

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Introduction

Knowledge can be considered the legitimating element of the teaching profession, which, in turn, transforms knowledge into relevant learning for students. However, a relevant question here is how do we learn how to teach? Although this question is difficult to fully answer, teacher professional development (TPD) suggests a continuous, dynamic, and unfinished process. Therefore, it is a process of learning, creating new meanings, transformations, changes in practice, and reflections on the teacher's professional trajectory. Moreover, it is a process that involves initial and continuing education, the teacher's routine educational work, values, beliefs and personal experience, the elements of professional culture, as well as several formative elements, which reinforce personal and professional growth and may promote changes in practice (Richit, 2021).

In this perspective, which characterizes professional development and where teachers develop personally and professionally, thus breaking the subject's unique individual construction to produce a collective construction between their peers, resides the understanding of humanization through appropriation and objectivation in educational work (Fullan, 1995; Richit, 2020; Saviani, 2008). Moreover, this process translates as dimensions such as knowledge, learning and teaching professional culture (Day, 2001; Guskey, 1997; Richit, 2021; Richit; Tomakelski, 2020).

Following this direction, the present study analyzes the professional learning of two early childhood education teachers during their training to teach Statistics and foster Statistics literacy for children in early childhood education.

In 2021, the Education Municipal Office in partnership with the Universidade Estadual de Santa Cruz (UESC), in collaboration with the Science, Statistics and Math Education Research Group (GPEMEC, Grupo de Pesquisa em Educação Matemática, Estatística e em Ciências), developed a research project with early childhood education teachers. The project involved a training process with a University-School Leadership ("USL"), typically a person from the early childhood education institution (teacher or pedagogical coordinator) who actively participates in the university's research group, that is, integrates both spaces. Thus, the training took place on a biweekly basis, on days and times predetermined by the USL training group. Due to the COVID-19 pandemic, training occurred remotely via Google Meet to teach and learn statistics and to expand the possibilities of pedagogical intervention with the children. Seventeen teachers of nine municipal schools of Itabuna, Bahia, Brazil, participated in this initiative, however, this article will focus on two of these teachers.

The process was based on a collaborative perspective, organized in ten meetings and thus distributed: i) proposal presentation to teachers; ii) investigative cycle presentation; and iii) statistical concepts in early

childhood education.; iv) reflections on the investigative cycle; v) teaching sequence socialization; vi) elaboration of new teaching sequence; vii) dialog for elaborating second teaching sequence; viii) new reflections on the investigative cycle; ix) challenges and advances; and x) teaching sequence second socialization.

In order to work the statistical concept studies with the early childhood education children, activities had to be adapted, such as planning, evaluating, replanning, partnering up with the family (as some activities required parents' support for execution), contextualized playful activities, interactive polls, electronic games creation, WhatsApp calls, producing videos with children's responses and interviews with children and their families in a collaborative way.

Dimensions of Teacher's Professional Development

The subject of teacher's professional development has been studied by several researchers (Ponte,1998; Guskey, 2002; Hargreaves, 2003; Shulman, 2004; Day, 2005; Desimone, 2009; Darling-Hammond, 2017; Richit, 2021;). There are various aspects involved in this movement of contemporary changes, including the conception centered on the professional learning of teachers (Day, 2001), content knowledge, active and collaborative professional learning and enough time for teacher learning. (Desimone, 2009; 2011). Evidence of the power of teacher's professional development, professional practices and students' learning results are present in the literature (Darling-Hammond, 2000; Hargreaves, 1995; Day, 2005; among others). Day (2001) corroborates by pointing out that teacher professional development (TPD)

> involves all the spontaneous learning experiences and consciously planned activities, executed for direct or indirect benefit, of the group or school and that contribute, through

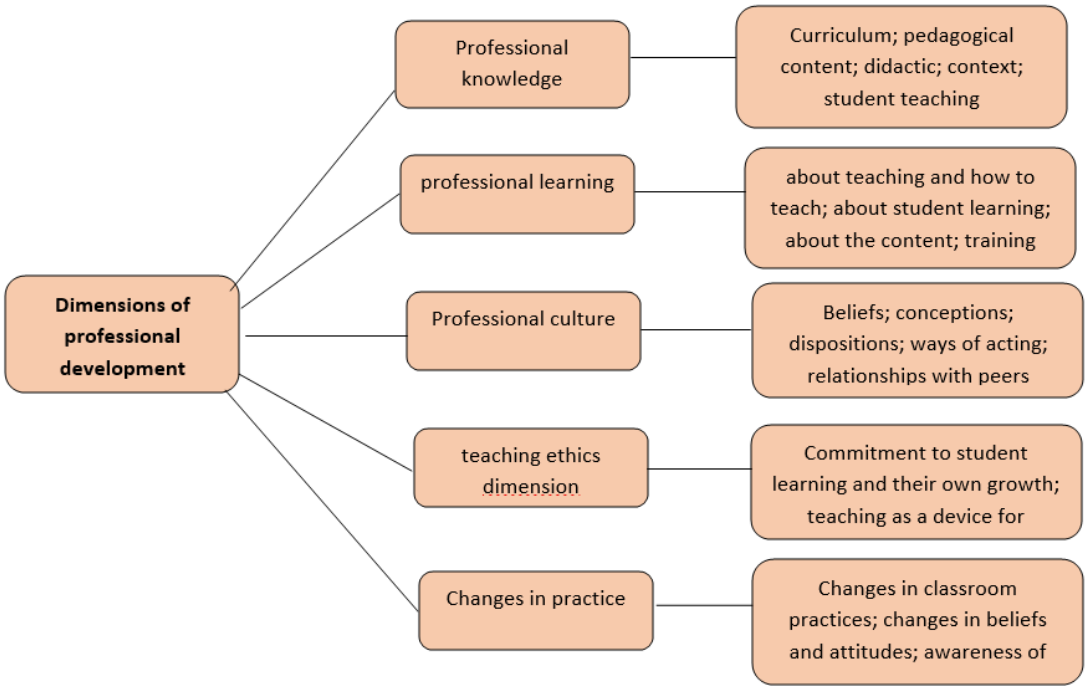
> them, to the quality of classroom education. It is the process through which teachers, as agents of change, review, renew and expand, individually or collectively, their commitment to their own moral purposes of teaching, and, along with students and colleagues, critically acquire and develop knowledge, dexterity and emotional intelligence, essential for a professional reflection, planning and practice in each of their professional lives (Day, 2001, p. 20-21).

According to the author, several formal and informal factors contribute to TPD beyond the realm of academic training. These factors include life history, experienced relations and spaces, ontological and epistemological knowledge perspective, classroom practice, and coexistence with the early childhood education institution. All these factors should be considered as part of the teacher, who is in a permanent process of development and evolution.

Moreover, teachers have different cognitive, emotional, and relational characteristics and should be provided with a professional learning environment that integrates pedagogical theory and practice.

Thus, in training that strives for TPD, it is of utmost importance to understand that the optimal results depend on the process being understood. “If we want to facilitate teacher professional development, we must understand the process through which they grow professionally and the conditions that foster this growth”. (Clarke; Hollingworth, 2002, p. 947). Figure 1 shows the TPD dimensions that comprise the theoretical research conducted by Adriana Richit (2021), one of the researchers who studies this subject.

Figure 1 – Dimensions of teacher professional development



Source: Richit (2021, p. 15)

The model presented by Richit (2021) comprises five dimensions woven together from teaching practice awareness. The categorization of these dimensions reverberates in underlying pedagogical knowledge that is somehow necessary and influential for teaching in the classroom.

Professional knowledge

Professional knowledge involves the initial and continuing education of teachers. When individuals choose to become teachers, they must continue learning for the rest of their lives. In this regard, they must own knowledge, search for alternatives, give new meaning to specific knowledge related to teaching, build a professional journey, and perceive and become subjects in their cultural-historical process.

Professional learning

The teacher's leading role in teaching leads them to different professional learning experiences. In this sense, Richit (2021) refers to the ideas of Day (2001), who attributes this fact to the professional development that occurs throughout the teaching career. Through lived experiences, be they spontaneous or planned, teachers can grow individually or collectively and, consequently, enhance the quality of classroom teaching.

In this regard, Day (2001) aims to expand the perspective regarding the professional learning universe by questioning the kind of learning performed by teachers, beyond understanding how and when this learning takes place. The professional trajectory of teachers is notably dynamic and complex due to several factors related to the everyday interactions of their practice.

Beyond these factors presented by Richit (2021), there is the connection between the teacher's training practice and the USL action, which contributes to the professional learning process through dialog, following up, monitoring, reflection, and collaborative construction, leading to changes in the professional attitude of the teacher subjected to this process.

According to Darling-Hammond, Hyler and Garder (2017), professional development is based on six principles that shape teacher professional learning, such as:

1. Is content focused.
2. Incorporates active learning.
3. Supports collaboration.
4. Uses models of effective practice.
5. Provides feedback and reflection.
6. Is of sustained duration.

Professional learning, according to the authors, is based on most or all of these principles, thus making children's learning possible. To ensure the ideal conditions for this process to occur, work between peers needs to be

organized and committed to the purposes of the group and the work areas must foster discussions on curriculum and their own institutionalization to enable curricular changes (Darling-Hammond, Hyler, Garder, 2017).

Thus, the implementation of professional learning, according to Darling-Hammond (2000; 2001), could contribute to the development of adequate and necessary strategies for the subject's constitution in their totality.

Professional culture

Hargreaves (1995) defines teachers' professional culture as a union of diverse situations experienced in teachers' daily lives with their peers and children, in addition to the way they behave and act in these spaces. This way, teachers express their values, habits, and practices that reveal an assumed professional culture.

In this perspective, some important elements are the way professionals relate to each other, how they react to unexpected situations, how they perceive and interact in the professional context, how they develop curriculum in the pedagogical practice, how they are encouraged to experience practice changes, how they take conjoint responsibility for and commit to educational work results, and how they inter-relate theoretical and practical knowledge.

External elements that constitute this dimension refer to several "external domain stimuli" (Santana; Couto; Paula, 2021, p.7) that correspond to continuing education, reading, conversations on instant messaging apps, informal conversations, pedagogical meetings, informal meetings, virtual meetings, among other elements. In this dimension, the USL, according to the aforementioned authors, contributes to the negotiations between the university (researchers), the early childhood education school board and the teacher, which simplifies the realization and (re)construction of theoretical and methodological concepts pointed out by the external group and the plans made with the teachers in the training meetings (Santana; Couto; Paula, 2021, p. 7).

According to the authors, it is through articulation, empathy and negotiations established with peers that USL can think collaboratively and collectively about their beliefs, values, and children's learning.

The ethical dimension of teaching

According to Richit (2021, p. 11), professional ethics is the "means through which the teacher acknowledges that their professional practice is an interactive, dynamic and flexible activity". Therefore, it is a collective act that must cater to the needs and interests of this collectivity.

In this regard, every act that favors social and ethical reflection, critical thinking, and decision-making is considered an educational activity that could promote quality and egalitarian education and helps overcome inequality of opportunities.

Changes in practice

The training process is based on a constant reflection between theory and practice. Moreover, the practice must transcend the classroom with the children of early childhood education and involve every activity performed by the teacher (Richit, 2020). In this regard, the children will gain access to the most complex elements in each knowledge area, considering that teaching promotes development. Furthermore, "…the more solid the theory that guides the practice, the more consistent and effective the practical activity" (Saviani, 2008, p.262), thus leading to changes in the classroom.

Methodological pathway

This study is designed as qualitative research, in which the investigator aims to better understand the process through which people build significance and thus describe their consistency (Bogdan; Biklen,

1994). In this sense, qualitative research presents interpretative characteristics with an emphasis on the significance of human relations from specific points of view.

Thus, this can be classified as descriptive and interventionist research. In this kind of research, according to Fiorentini and Lorenzato (2012, p. 69), the researcher, "confronted with a problem or theme still little defined or known, decides to devise a study to obtain more clarifying and consistent information or data".

The training process was developed from the research project proposed by the Northeast Mathematics Education Network, during the social distancing of the COVID-19 pandemic. The training was conducted via virtual meetings using the Google Meet platform in ten sessions of four hours, totaling 40 hours. The participants were 17 teachers from ten early childhood education institutions, two of which were selected for this article, one who works in daycare and the other in preschool. To protect their identity, the teachers have been given fictional names. This research project was approved by the Ethics in Research Committee under number CAAE 26229119.1.1001.5526 and opinion number 3.813.638.

During the training sessions, the teachers prepared teaching sequences about statistics to be developed in the classroom with the children of early childhood education children (aged 3 to 5 years old and 11 months). These sequences aimed to teach statistical concepts and foster statistics literacy. Teaching sequences were presented in activity blocks distributed to the children on a biweekly basis. In addition to written activities, virtual activities with the families were proposed.

The teaching sequences approached the abilities of exploring, observing, and recognizing different numerical carriers and the information they contained in lists, tables, and graphs and participating in research and data collection. Statistical concepts were explored through themes, such as recycling, gardening, and circus. These themes passed through all the following experience fields: Listening, Speech, Thinking

and Imagination, Body, Gestures and Movement, Space, Time, Quantities, Relationships and Transformations, The Self, the Other and Us, Traces, Sounds, Colors and Shapes.

The methodology used to approach the learning of statistical concepts with the teachers during training was the investigative PPDAC cycle proposed by Wild and Pfannkuch (1999). As indicated in the acronym, this cycle consists of the following five stages: Problem (P), which relates to acknowledging the data context, defining the problem or phenomenon to be investigated; Plan (P), which includes defining the actions needed in the investigation; Data (D), which includes the process of data collection; Analysis (A), which relates to the data treatment and analysis, and Conclusion (C), which closes the investigation about the proposed problem with critical, reflexive thinking followed by communicating the data. Thus, it is possible to generate new ideas and questions.

The data produced in this study originated from a semi-structured interview with two teachers who worked in early childhood education in the city of Itabuna, southern Bahia, Brazil, who shall be referred to as Ana and Diana in this study. The teachers' selection catered to some criteria established by the research group, namely participation in every meeting, completion of teaching sequences in full, engagement in the research, and availability to partake in the interview. The interviews were conducted individually based on the question: How do you evaluate the training process regarding your professional learning? From that starting point, it was possible to analyze the professional learning revealed in the teachers' testimonials.

The data were analyzed using the Discourse Textual Analysis methodology, which, according to Moraes and Galiazzi (2006), is described as,

> […] a process that starts with unitarization, in which texts are separated into units of meaning. These units by themselves can generate other sets of units originated from empirical

> interlocution, theoretical interlocution, and the researcher's interpretation." (Moraes; Galiazzi, 2006, p.17).

The movement starts from the unitarization of texts, which are organized into units of meaning that result in categories. The texts generated by the teachers' testimonials were dismantled and their units were categorized in the aforementioned professional development dimensions.

The professional development dimensions had the training meetings as starting points. During the meetings, it was possible to observe that the teachers kept themselves curious, and eager to learn more, while reflecting on their own practice and questioning the activities they should propose to children and what learning ~~concepts~~ the activities actually offered them, even remotely.

Results analysis

This section contains the categories identified by analyzing the teachers' testimonials. The interviewees were asked the following question: *How do you evaluate your statistical knowledge and learning during the training process?* Based on the unitarization, it was possible to identify the categories shown in Table 1.

Table 1 - Dimensions of Professional development declared by the interviewed teachers.

Description (unitarizations)	Category
- Deepening and redefining knowledge - Expansion of professional trajectory - Insecurity or lack of control over the content - Diversified strategies - Training process presented to teachers - Recursos didáticos utilizados (WhatsApp, vídeos, atividades impressas) - Questions about what to teach and how to teach	Professional knowledge
- Teacher's role - Different learning - Planned experiences - Individual growth - Improvement of the methodology	Professional learning
- Articulation between theory and practice - Knowledge and values developed in training processes -. Fomentação da intervenção em sala da turma com questionamentos, reflexões - Review the routine - Reflect on practice - Experience changes	Changes in practice

Source: Research (2021)

According to the categories listed, it was possible to identify three dimensions of professional development: professional knowledge, professional learning, and changes in practice.

Category: Professional knowledge

The analysis produced evidence about how a remote training process can empower teachers' professional learning, by means of statistical concepts in early childhood education during the COVID-19 pandemic. The greatest challenge of this process, in addition to conducting the research online, is related to the teachers' insecurity towards mastering the content. According to Shulman (1986), knowing the content allows the teacher to understand its relevance and social use, as well as expand the potentialities of interventions. However, their lack of knowledge limits their course of action, as it prevents teachers from acknowledging which learning outcomes are possible and which difficulties need to be worked on with their students.

Educational work is vital to the teaching profession, whose prime dimension is teaching. To Day (2001), this activity demands active participation from teachers throughout their professional career in development circumstances that promote achievable teaching goals by means of effective, quality, and egalitarian pedagogical practices. Thus, the teachers' personal and professional growth involves, "every and any activity or process aimed at improving teachers' knowledge, attitudes, beliefs, dispositions, understanding and actions in their present or future role" (Richit, 2021, p.2).

The provision of several moments for the teachers' professional learning to occur is of utmost importance to the TPD. Thus, when asked about their learning during a training session in this research in 2021, during the pandemic, the teachers declared they felt insecure at first, for not mastering the content. However, they highlighted the importance of coordinating theory and practice, experience exchange among peers, thinking about what to teach and how to teach, the University-School interventions, and partnerships with the families.

Another factor revealed by the teachers was the need for deepening and giving new meaning to content during the training sessions. They kept asking what to teach and how to teach, especially regarding the statistical content. Scholars such as Shulman (1986) and Ponte (1995) ponder that teachers need to master mathematical knowledge to ensure effective and quality teaching, even for elaborating teaching sequences. The training process revealed the importance of working statistical concepts in early childhood education, especially in the teachers' continuing education, as proven by the following teacher's testimony:

> "... I like working mathematical content, but how do you teach mathematics to three-year-olds?" (Teacher Ana's testimony)

The interviewed teacher's statement is somewhat incoherent, as she states that she likes working with the subject but does not know how to work it with the children. According to Darling-Hammond (2000), teachers need to know the content well so they can relate it to daily life and thus lead students to connect ideas and concepts, in addition to mathematizing coherent learning journeys.

That way, statistical concepts appeared as an obstacle and, as the interviewees highlighted, they did not believe the children would get a hold of these concepts. It is important to highlight the ways of exposing content to students and which strategies and resources teachers should use to mediate this process of acquiring knowledge.

According to Shulman (1986), teachers need to have a clear understanding of the content's level of difficulty, and what knowledge is pertinent to each stage of schooling, in addition to considering the singularities, learning potentials, and challenges of each child.

Throughout the training process, the teachers began to understand the need to use different resources, such as WhatsApp, internet videos, videos made by them, printed activities, playful polls, production and elaboration of

electronic games, as well as partnering up with families for intervening in the proposed activities as possible alternatives to be used for acquiring the mathematical concepts worked with the children.

These planned activities and interventions that are carried out in several spaces, be it in person, remotely, formally, or informally, and that promote analysis, reflection, and discussion of practices and teaching materials constitute professional learning that must be constructed throughout the teachers' careers. As teacher Diana reaffirms:

> "... We are always sharing experiences, either via Google Meet or in the study groups, 'Hey guys, watch this!' Someone else says: 'I found this!' You know? Within the theme we choose together, always interacting with one another, great group, great group!" (Teacher Diana's testimony)

Thus, knowledge of the content supports what Richit (2021) calls "balance in the tension between guidelines provided in the curriculum and teacher's choices" (p. 6). Therefore, these choices favor knowledge building as they soften challenges, institutionalize understanding of concepts and content, and relate them with awareness of reality, besides establishing a partnership and creating a learning bond with the families, who also grasp the knowledge.

Category: Professional learning

Professional teacher learning involves several formal and informal activities and occurs in different moments, which guide the processes of perfecting thought, in addition to thinking about the teaching practice, with their professional commitment (Day, 2001). That way, the research tried to diversify the training spaces and periods, such as collective virtual meetings with all the teachers, *in locus* meetings in the context of the early childhood

institution, *WhatsApp* group chats, interventions or individual counselling by USL for the study and replanning of teachers, in addition to formal meetings. This was considered something new that triggered many uncertainties, as told by teacher Ana.

> "... This was new to me, you see? This virtual training condition. It's just... We go into online training without knowing what's coming. We don't know if it's going to work, due to the challenge of the online experience, of being used to in-person training, where... You expose more of yourself, you... Like, how is this going to work with so many teachers? So, I had this fear and said, 'Is this really going to work?' Everybody talked at the same time…" (Teacher Ana's testimony)

These spaces can reinforce possible changes in the training processes and diversify learning under the perspective of "knowledge building in collective spaces of thought and action [...]" (MOREIRA, PRYJMA, 2022, p. 2). In those spaces, the aim is to value and stimulate knowledge production and reflect on the practice to promote understanding of their teaching practice beyond making changes through decision-making based on their needs. Teacher Diana's testimony highlights the importance of USL in the training process and in interactions among coworkers.

> "… My coworkers consulted Adriana[5] privately all the time, but I talked to her a lot to clear some doubts or come up with ideas that we'd later share in the group chat to see what the others thought about it. I'm sure they all consulted her at some point, which was a constant dynamic. This also happened in private with some of our coworkers, they would go to Adriana and ask things like 'but you see, I work with infants, how are we going

[5] University-School Leadership representative in this training process with teachers of early childhood education.

> to adapt that?' And then an idea would come, then another, in a group you always have people who are shier than others and won't talk in the group chat, they felt more comfortable reaching out to me directly, or Adriana, and that's how it went..." (Teacher Diana's testimony)

These training spaces showed the importance of the other to elaborate or create knowledge mediated by dialog, collectivity, and experience exchanges, as shown in teacher Diana's testimony.

> "... We had training lectures via Google Meet, due to the pandemic, but they were always very productive, we learned a lot, it was dynamic, we could speak our minds, discuss, and learn everything about the process, it was all very good, Silvana is a person who helps and everyone around her feels at ease. For me, who loves to talk, it was great, I was always there. (Teacher Diana's testimony)

That way, by incorporating the different experiences generated from social relations, lived in different contexts and different perceptions and ways of constituting oneself as a subject of the process, mediation between peers was consolidated and allowed the teachers to become protagonists. The relationship with the educators who participated in the training sessions contributed to the effective development of the training process, as confirmed by teacher Ana's testimony.

> "... I was apprehensive at first. But it was really, really nice. In the meaning that, in this training, the instructors made us very comfortable. So comfortable, we didn't feel like it was one of those stiff processes: 'Oh, training that I am obligated to attend. Something I must do...'. It was like a chat, about our experiences, and it ended up being about our experiences during the pandemic, in which everyone had to reinvent themselves. So, this training was

> agreeable. And very rich also, right? Because we had the opportunity to talk to several teachers more familiarly. Because, in in-person meetings, you give your opinion, the other ones give their opinion, you learn. But in the remote training, it was as if you were talking to that teacher who was giving their opinion at that time. It seemed we were closer to them; it was a very rich exchange..." (Teacher Ana's testimony)

The teacher's testimony indicated that the virtual environment can also provide grounds for a training process that contributes to the teachers' professional development, as well as fostering collaboration and experience sharing among peers.

Category: Change in practices

It is known that the act of teaching articulates theory and practice to promote student learning. By developing activities with teaching sequences, planning, and replanning with a focus on learning, the teacher and child become both active and participative agents of this process, as stated by Santana, Serrazina, and Nunes (2019). Reviewing routines, reflecting on this practice (Day, 2001), taking risks, and experiencing changes (Hargreaves, 1995) are elements of professional development.

These ruptures with the daily practice developed in the classroom, according to the interviewed teachers, promote discovery.

> "... The training helped me see that I was already doing something without knowing it, which was research…";
> Intention: "I think when you realize you are doing research with your students, the intention is greater, the goal is more detailed. And this training did this, right?";
> It expands knowledge: "I expanded my way of working, of researching due to this training. I think study and knowledge do that, right? You

> don't speak of what you don't know. You only speak and teach, you only feel like you transmitted your knowledge, right?"
> Gives new meaning to knowledge: "You share knowledge that you are certain to have, when you are sure you are not talking superficially, and this training did that!";
> Reflection upon practice: "Today I work with my students knowing I am researching and that my goal is more detailed. So, there I need to delve more deeply, here, not so much. So, it's not just one goal to be met, it's a goal that is broader, richer, that takes some time to achieve"; Then it makes it possible to change beliefs and attitudes: "This training did this, so all the doubts and questions I had dissipated. I wasn't sure if this was going to work out as online training... But it was great. One of my questions was, how do we research with three-year-olds? How do I do a questionnaire with three-year-olds? It's possible! I've learned it's possible. And that it works..." (Teacher Ana's testimony).

These changes mobilize and sustain teachers' beliefs and attitudes through practices and students' learning results, as teachers show they are committed to new practices by engaging in implementing them (Guskey, 2002). This is a gradual and complex process for the teacher, because, according to the author, "learning how to be proficient in something new and attributing different meaning to the things one does requires time and effort, as well as availability to take risks" (p. 14).

Therefore, the statements of the interviewed teachers showed they tried to overcome the dichotomy between theory and professional practice while trying to give new meaning to their practice through theory, reflection, discovery, and research.

Considerations

The training process of this study fostered professional learning of early childhood education teachers by putting the participating teacher at the center of the process. The results showed that the teachers needed to understand the goal of this training so the process would be effective and consistent. In this regard, the interviewed teachers felt the need to study and turned to *WhatsApp* group chats to understand, talk, ask, ponder, clear doubts, that is, interact with their peers collaboratively and collectively. In addition, they referred to USL as support for clearing doubts and moving forward in the training actions.

The teachers started trusting the possibility of reviewing and reflecting on their practices for teaching certain statistical concepts. Creating a collaborative and collective way of working made it easier to engage teachers and their learning regarding the specific knowledge of statistics and how to develop investigative classes with children in early childhood education. These actions were reflected in the professional learning of participating teachers.

From the analysis, the following four main aspects of this training process were considered: i) the training of teachers who work in the classroom must reflect their own professional practice; ii) the training process can happen in different spaces, ways and means, as it is a collaborative initiative that happens collectively and depends on the other; iii) it must provide teacher engagement and commitment continuously and permanently; iv) involvement of the USL helps develop professional learning training strategies between teachers and instructors.

Teachers' professional development happens in all teaching creation and recreation spaces, in following up from initial education to continuing education, in a range of daily professional practices, life stories, beliefs, and values that must connect to and be a part of teachers' professional trajectory. Although it is a slow, continuous, and permanent process, individual and institutional commitment are essential.

Continuing education is the starting point for professional qualification and a condition for continuous teacher professional development. These assumptions reveal that the training process must be permanent and consolidated into an educational policy that significantly contributes to teachers' professional practice.

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