

CONTENT OF THE WRITTEN REFLECTION OF A FUTURE MATHEMATICS TEACHER

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Abstract

Professional reflection plays a central role in the construction and development of the professional knowledge of teachers and future teachers. For the authors of this paper, reflection is understood as a mental process of trying to structure or restructure an experience, a problem, or existing knowledge, leading to an understanding of the said, and constituting a continuous process of analysis and refinement of practice, in which the recursive character and cyclical nature briefly define the way it takes place. It is important, then, that teachers or prospective teachers engage in systematic reflection that is integrated into their daily practice. It is accepted that reflection gains strength when mediated by writing. Therefore, it is important to understand what teachers and future teachers reflect upon and create conditions that allow them to improve/deepen the reflective process. It is in this context that the study presented in this paper emerges. It is contextualized in the Final Internship Report of the Master's Degree in Primary and Middle School Teaching in the School of Education of Bragança, prepared and publicly defended by a future teacher. The study focuses on the content analysis of the written reflections on a teaching and learning experience (TLE) carried out in the mathematics classroom on the topic of "Data organization and processing". In this analysis, we sought to understand the incidence of reflection in the three stages of teaching practice, giving rise to the defined three categories and several subcategories of analysis: (i) Planning the TLE (what did you think of doing?); (ii) Development of the TLE (what happened in the classroom?); and (iii) Learning achieved in the TLE (what is the balance to be made?). In the written reflections, the future teacher revealed, for example, her concerns about creating stimulating learning contexts for her students, the relevance of her students' performance assessment practices, the diversification of her students' ways of working, the importance of developing positive attitudes towards mathematics or the projection of future work to be developed.

Keywords: Reflection on practice, written reflection, reflection content.

1 INTRODUCTION

In this paper it is our aim to analyze the content of a future mathematics teacher's written reflection on a teaching and learning experience developed in her professional master's internship and presented in her final internship report.

Several authors, such as Eynon [1], Kwon and Orrill [2], Lee [3], Schön [4] and Sellars [5], recognize the essential role of reflection to interpret, understand and make sense of a teacher's professional activity. When reflecting, teachers construct their own theories about the teaching and learning process in which they are involved, as also referenced in the literature, namely in Korthagen [6] and Passos et al. Also, as Martins and Santos [8] and Meireles [9] refer, reflection can gain strength and depth when mediated by writing, especially since, when writing, the teacher becomes aware of his/her own learning process.

As evidenced in previous publications [10], [11], when we talk about teachers' reflection or professional reflection, we consider it as a mental process of trying to structure or restructure an experience, a problem, or the existing knowledge, leading to the understanding of the same and constituting a continuous process of analysis and refinement of the practice, in which the recursive character and the cyclical nature briefly define the way it takes place. However, considering that teachers need to be reflective practitioners presupposes attending to the aspects that reflection includes (content) and, simultaneously, to the evaluation that is made about them (depth), because, as Lee [5] states, it is necessary to go beyond arguing that it is necessary to "put" teachers to reflect. Particularly, concerning the content of written reflection, in a study reported by Martins and Santos [8] it was found that the content of written reflections contained in the portfolios of teachers participating in an ongoing training program in Mathematics for teachers of the 1st cycle of basic education focused on the tasks

experienced, the importance that these had for the teachers, the effect they produced on their students and future teaching perspectives. It should also be noted that reflection is stronger when mediated by writing, since when writing, the teacher is naturally led to interpret, organize and articulate his/her ideas, it being essential to substantiate their practices and actions and become aware of what needs improvement to contribute to the academic success of their students and their professional development.

2 METHODOLOGY

The study follows a qualitative and interpretative approach, considered very adequate by Amado [12] and Bogdan and Biklen [13] for this type of study, seeking to understand what is unique and particular to the future teacher in her reflection on a teaching and learning experience (TLE) of Mathematics developed during her internship. The TLE presented assumes characteristics of action research and research on practice, in the sense of Ponte [14] and focused on the theme "Organization and processing of data". The future teacher based the writing of the TLE, carried out in a 6th grade mathematics class (students aged 11-13), on field notes recorded in a logbook built throughout the professional internship, on direct observation of the students' activity in class and on the analysis of their productions and opinions.

The analysis of the written reflection was oriented towards the identification of its content. The first contact with these reflective references was made through a floating reading [12] of the TLE, which evolved to more and more systematized readings, trying to identify what the future teacher reflected about and what she valued most in Mathematics and in the teaching and learning process of this area of knowledge. To achieve the objective, we used the categories and subcategories published in previous studies [10], [11]. This categorization took into account the three moments of the teaching practice: (i) planning the TLE (what did you think of doing?): path taken; and global assessment; (ii) development of the TLE (what happened in the classroom?): structure and organization of the TLE; organization and management of the classroom; communication in the classroom; student activity - tasks; student activity - attitudes; teacher activity; and (iii) Learning achieved in the TLE (what is the balance to be made?): student learning; and teacher learning.

As it can be seen, the definition of the three categories took into consideration the phases that are usually associated with the teacher's teaching practice: pre-active, interactive and post-active, according to Clark and Peterson [15] and Santos [16]. The definition of the Planning TLE category took into account that it is a fundamental component of the teaching process, being essentially devoted to reflection on the path taken to carry out the planning and evaluation of its execution. The definition of the Development of TLE category was based on the assumption that in creating the classroom environment, in addition to the importance of the physical context, including the materials used, it is important to foster an environment that encourages the development of mathematical aptitude and competence. The category Learning achieved in TLE was defined by considering that teachers reflect on their practice, their attitudes, strategies, thoughts and decisions in order to attribute meaning to situations and to improve their personal and professional practice.

3 RESULTS OF THE WRITTEN REFLECTION ANALYSIS

This section presents aspects of the analysis of the future teacher's written reflection following the three main moments of teaching practice; (i) planning the TLE; (ii) development of the TLE; and (iii) learning achieved in the TLE. Quotations from the future teacher's direct written discourse are enclosed in inverted commas.

3.1 Planning the teaching and learning experience

In the future teacher's written reflection, it is apparent that in planning the experience she took into consideration the attitudes that students and teachers have about mathematics and can influence the consequent teaching and learning. It was her stated concern to support her reflection in reference literature, highlighting the more static or more dynamic nature of this subject. She stresses the importance of the teacher's dynamic knowledge, linking it to the exploration of situations and the sharing of opinions:

"One must then focus the goal towards influencing students in the way they see and view mathematics which, in the long run, becomes a key factor to their understanding and engagement. (...) I selected a

task that departed from this very idea and allowed for self-exploration or the sharing of ideas and arguments.

In this TLE, the future teacher explained the mathematical topics to be worked on: "tables of absolute and relative frequencies, bar charts, circle diagrams", in order to fulfil the objective "construct and interpret tables of absolute and relative frequencies, bar charts, circle diagrams" and using different ways of representing information. She clarified that she valued the stages of a statistical investigation: (i) defining a question to investigate; (ii) selecting the types of variables to be treated and collecting data; (iii) organizing and processing the information collected; and (iv) presenting the information and establishing conclusions. Accordingly, she reflects on the mathematical work to be developed by her students, especially the work of a more open and exploratory nature, concretized in the tasks they solve in class. By thinking of proposing a "free" investigation, the future teacher intended to provide, to her students, moments of a greater autonomy in the search for paths and solutions. However, motivated by time constraints, she extended the reflection on the integration of tasks of investigative nature in the mathematics classroom by relating it to implications in curriculum management and development and in the roles played by students and the teacher, namely in the validation of processes and results:

"Due to the curricular management of the time allocated to the theme, the option was not for an "integral" research work, but only for some important aspects of the investigative work. (...) It becomes fundamental to increase the students' sense of autonomy, refusing the idea that the individual should only assimilate information mechanically (...) making students more capable of making new reformulations and experimentations".

Moreover, she justified the choices made on two aspects that she considered particularly important in this lesson: (i) the students' prior knowledge, specifically knowing how to represent information in different ways; and (ii) the use of a medium other than the usual, the Excel spreadsheet software, for them to perform the representation of two graphs [bar graph and circle graph].

3.2 Development of the teaching and learning experience

In the development of the TLE, the future teacher focused on the organization and management of students' work in class, and the influence of reflection in changing her teaching choices from proposing individual work to working in pairs was visible. In reflecting on the most appropriate way for students to work in class on solving a task, she highlighted the important role of interactions and communicative processes in the classroom and emphasized that different modes of organization require, for the teacher, different ways of managing the teaching work:

"In a first phase, the idea that best convinced me would be individual work (...). However, on further reflection I see advantages and agree that peer interaction can contribute to the personal development of the student, although it adds new demands on the teacher. In group work, there is a greater concern on the part of the teacher, since all groups presented quite different work pace, (...) required constant mobility, a more detailed and individualized follow-up, most of the time to clarify points that had already been mentioned in a first collective explanation. (...) [Peer interaction] promotes students' self-esteem, showing them that their arguments and reasoning are listened to and respected, learning to modify strategies as necessary and defending their points of view."

In her reflection, she evidenced the involvement and performance of the students, who took more active roles in their learning, resuming the relevance of developing positive attitudes towards mathematics:

"The activity experienced evidences a frankly positive receptivity and productivity from the students (...) turning the student into a participating, critical and argumentative individual. This type of activity allows us to change the "traditional" image of mathematics which is rooted in the students.

For this future teacher, this greater protagonism of the students in the classroom has also consequences for her teaching practices, which should be more oriented towards an exploratory type of teaching as opposed to a direct and essentially transmissive type of teaching:

"A change is sought in the way they see Mathematics, calling for the replacement of transmissive strategies by more active ones, diversifying the instruments used and evolving towards processes that allow sharing and adding new information."

Assessment practices were highly valued by the future teacher, letting it be understood that she normally integrated them into classroom routines and that she paid special attention to their formative dimension:

"All the works were identified and (...) collected, in digital support, for further evaluation. It is necessary to maintain evaluation practices in all lessons and, in this case, it was not an exception. This evaluation was more focused on aspects of behavior, responsibility and the ability to work in groups, emphasizing the student's own effort. I also gave importance to the final product of the students' productions, since it informs whether the steps followed during the process were the right ones".

The future teacher reflected both on the attitudes or behaviors and processes that the students developed and, on the products, and productions they performed, seeking to value what her students achieved:

"I did not evaluate them quantitatively given that the main intention was to provide the first contact with different calculation tools, which gave rise to quite strong help from all teachers and therefore the productions were highly supported. In general terms, the final results also had no great discrepancies, and the different [usual] levels of student learning were not evident. In fact, if any distinction can be made, the students considered to be weaker performers presented more "exquisite" graphics in aesthetic terms. At the end of the lesson I asked students to identify [in writing] the main difficulties they experienced in using (...) Excel, as well as the usefulness and benefits of using the spreadsheet in organizing and processing data."

With the request for comments at the end of solving the task, the relevance that the future teacher gave to the students' opinions and points of view is evident, diversifying the sources of information collection.

3.3 Learning achieved in the teaching and learning experience

In a number of written reflections, the future teacher posed and substantiated alternatives to the option she had chosen, especially when she found that, from her point of view, it had not been very successful. Looking at the preparation and implementation of the task, she felt that it would have been more useful for her students to have given better suggestions and more complete guidance for the work to be done in pairs:

"If I had more time, it would possibly be more meaningful to provide the students not with the worksheet, but with a guide with the steps to follow for carrying out the activity. In this way each student would feel more responsible (and more autonomous) to carry out the tasks, since they would not have to wait for the other groups to advance in the procedures of the activity. This behavior favors the concentration on the work, avoiding moments of dispersion, and the development of communication with the pair colleague or with the teacher".

She also considered that it would have been more meaningful for the students to have chosen to request the production of a written report, as it would have given them better opportunities to record, interpret and communicate their opinions and productions:

"Although the time allocated for the teaching unit did not allow it, it would have been a good option to propose to the students to produce a written report on the work done. The activity would have provided the development of interpretation skills and consequent mathematical communication, through a written and individual analysis of the conclusions drawn from the graphs produced."

In her projection of her future professional activity, she explained one of her main learning experiences, considering that all the work carried out made her aware "of the fact that there is a real need for (future) teachers to reflect on their professional practices and that this fact should be part of the continuous process of what it really means to be a teacher", thus highlighting the relevance of reflective processes in the construction and development of her identity as a teacher.

4 CONCLUSIONS

The future mathematics teacher's written considerations about her work show characteristics associated with reflection highlighted by authors such as Eynon [1], Lee [5], Schön [3] and Sellars [4], such as structuring, intentionality, continuity, interpretation or analysis. As a future teacher, she demonstrates a great concern with reflective processes and, through them, seeks to understand and give meaning to her teaching practices, aspects highlighted by Korthagen [6], Martins and Santos [8], and Passos et al. This appreciation, combined with the practice of reflection, allows her to discuss and seek other solutions or other ways to solve situations posed in her teaching activity, be more aware of the complexity of her students' learning environments, have a more articulated and global view of her teaching practices, and recognize the importance of integrating reflection into professional life, as highlighted, among others, by Kwon and Orrill [2], Meireles [9], and Sellars [4].

The content of the future teacher's reflection on the planning of the TLE focused on the attitudes that students and teachers have about mathematics and their influence on the teaching and learning process; the importance of the teacher's dynamic knowledge and its connection to the exploration of situations and the sharing of opinions; the mathematical topics to be worked on; the presentation of the stages of a statistical investigation; the relevance of work of a more open and exploratory nature and the implications of this for curriculum management and development and the roles played by students and the teacher; the consideration of students' prior knowledge; and the use of technological means in the teaching and learning of mathematics.

The content of the reflection on the development of TLE focused on the organization and management of students' work in the classroom, namely the choice of individual or group work; and the role of classroom interactions and communication and consequently the demands placed on the teacher to manage the teaching work. It also centered on the active role of students in the achievement of their learning and the consequences of this choice in the teaching practices. She found that an exploratory type of teaching fulfils the purpose of making the student the protagonist in the teaching and learning process and contributes to the development of positive attitudes towards mathematics. The content of the reflection also focused on the valorization of formative assessment practices and the diversification of sources for gathering information about the students, as well as the attitudes/behaviors and processes that the students developed in carrying out the proposed task and the products they presented.

The content of the reflection on the learning achieved in the TLE focused on the indication of alternatives to the option followed in the introduction of the proposed work; on the advantages that the completion of a written report would bring; and on the role of the teacher in the organization of work in pairs. In her reflection she also valued the relevance of reflective processes in the construction and development of her identity as a teacher.

Thus, it is evident that the content of the written reflection produced involves a great diversification, highlighting very relevant dimensions for a better understanding of the classroom dynamics and the roles played by the various actors.

To conclude, the words written by the future mathematics teacher should be highlighted, emphasizing the relevance of reflection in the learning processes, considering that it is fundamental "to adopt, throughout our career, a flexible, self-critical, reflective and self-evaluative attitude, being fully aware that in the whole educational process the students learn from the teachers and the teachers learn from the students. I think this will be the best way forward to become better and better professionals".

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