Chapter 11
Learning the Parallelogram Area With Technology Supported by Formative Assessment

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ABSTRACT

This chapter presents an empirical investigation in which we developed formative assessment strategies with mathematical tasks using technology. The study is interpretative in nature, in a case study format. We designed assessment strategies in a collaborative work context, performed in a Mathematics classroom with 5th-grade students. Evidence shows that the use of peer assessment has had an impact on the learning of the parallelogram area with the help of the written feedback provided by their peers and the contact with the work of their colleagues, they managed to develop a conjecture for the parallelogram area.

INTRODUCTION

Mathematics teaching should increasingly focus on the creation of opportunities for the active construction of knowledge involving students in individual and collaborative experiences "that promote their ability to make sense of mathematical ideas and reason mathematically" (NCTM, 2014, p. 5). The study of geometry with younger students should encourage them to think and to do. Thus, while students draw, classify, or measure, they are developing their visualization skills. They are also "learning to reason and formulate, test and justify assumptions about relationships" (NCTM, 2007, p. 191).

In order to be able to support their students' mathematical learning, teachers should seek evidence from a variety of sources and ensure the convergence of this evidence so that each student can show their strengths - the main purpose being to obtain information that supports the learning and teaching of mathematics. In this way, students should not only be assessed, but on the contrary, the assessment

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should be made for them, to guide them and improve their learning (NCTM, 2007; 2014). Therefore, the teacher should know what he or she needs to focus on, and he or she should challenge students with questions suited to the situation providing assessment evidence to help them build their own knowledge by developing a dynamic assessment that ensures success. It is also necessary to listen to students as they work in mathematics (Storeygard, Hamm, & Fosnot, 2010). Therefore, formative assessment inevitably requires the involvement of the student because the learning is achieved by the student himself, and no one learns for the other person (Bruner, 1966). Given that formative assessment is not valid on its own but instead for the contributions it can bring, for the way it can contribute to improving learning, therefore identifying the impact and effectiveness of formative assessment is crucial. Assessment should occur regularly in the classroom instead of appearing as an interruption of the teaching activity, thus contributing to effective, quality learning for all students (Black & Wiliam, 2009; NCTM, 2007; Storeygard et al., 2010).

This chapter presents an experimental investigation in which we developed formative assessment strategies with mathematical tasks that use technology. The assessment strategy referred to here includes the use of assessment criteria and peer assessment. The students analyzed the work of other students, their colleagues, and provided written feedback. Using this strategy, students got involved in their own learning by contributing to overcoming their learning difficulties. The difficulties that students reveal regarding the notions of area and perimeter suggest that they do not relate these concepts with the properties of the figures under study (Steele, 2012). The task presented to the students was for them to make a conjecture about the parallelogram area. To this end, it called for the use of the GeoGebra software to support their learning experiences.

This chapter presents the conceptualization of the theoretical framework of the formative assessment that supports the research, as well as practices of formative assessment, namely the use of assessment criteria, oral and written feedback and peer assessment as well as mathematical tasks that use technology and formative assessment. It also includes a section on the methodological and context aspects of the research. This is followed by presenting the data resulting from the research, on how the teacher involved the students in a formative assessment practice and how he identifies the impact of formative assessment on the learning of the parallelogram area. Finally, we present the main conclusions.

FORMATIVE ASSESSMENT PRATICES

Formative assessment

In order to provide a theoretical support for the formative assessment, Black and Wiliam (2009) refer three key processes in teaching and learning, which are to identify: (i) where the learner is right now; (ii) where the learner is going; and, (iii) what needs to be done to get there. Traditionally, the teacher is responsible for each of these steps; however, it is necessary to consider the role of students and their peers, in this process. By crossing these three processes with the three agents (teacher, student and their peers), five strategic categories are obtained which are consistent with the formative assessment of learning. They are the following:

1. Clarifying learning intentions and criteria for success thus making all those involved in the learning process aware of the intentions and the elements of assessment;

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