Formative Assessment Practices of Middle School Mathematics Teachers in the Dominican Republic

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Abstract
This descriptive phenomenology study investigated middle school mathematics teachers' formative assessment practices in the Dominican Republic. The study explored three research questions about the types of formative assessment strategies teachers implemented, how they used formative assessment data to make instructional decisions, and the challenges they faced implementing these strategies. Eighteen middle school mathematics teachers from public and private schools in three southern cities took part in the study. The data collection consisted of semi structured interviews, focus interviews, and reviews of mathematics lessons. The findings of this investigation showed that teachers implemented various formative assessment strategies and took an active role in the process. Thus, teachers rarely engaged students in peer assessment, self-assessment, collaborative work, and other methods that promote students' ownership of the learning process. While some teachers used formative assessment data to adjust instruction, others used the data to provide academic intervention to students or assign a grade. Finally, teachers experienced contextual and personal challenges implementing formative assessment, such as students' limited skills in mathematics and motivation, large class sizes, limited resources, and time to plan and implement formative assessment. Contextual factors relating to students' current performance and motivation were the most usual challenges reported by teachers.

Keywords: Formative Assessment, Assessment for Learning, Feedback

Introduction

Formative Assessment in Mathematics

Researchers have found five critical formative assessment strategies that positively affect mathematics instruction and student learning (Bennett, 2011; Leahy et al., 2005; Oswalt, 2013; William & Thompson, 2008). When using effective formative strategies in mathematics, teachers should (a) clarify and share learning progressions and success criteria, (b) create effective classroom discussions (questions and learning tasks), (c) provide feedback to improve student outcomes, (d) create opportunities for students to be owners of their learning by engaging them in self-assessment, (e) activate students as instructional resources for one another through peer and self- assessment (Silver & Mills, 2018). Peer and self-assessment in mathematics provide students with opportunities to assess their knowledge, reflect, and improve the quality of their learning (Michael-Chrysanthou & Gagases, 2014; Swan & Foster, 2018). Furthermore, mathematics teachers should collect evidence of student learning to make instructional adjustments, assess the appropriateness of curriculum, and establish goals for students (Siegel & Wasser, 2011; Veldhuis & Van den Heuvel-Oppenhuizen, 2020).

Formative assessment in mathematics varies. Curriculum-embedded formative assessments are often included at different points in the curriculum sequence to assess students' mastery of the standards (Cizek et al., 2019; Heritage, 2008; Shavelson et al., 2008). These assessments provide teachers with feedback on students' readiness, inform the teacher of students' current performance, and address any learning needs to help teachers provide timely feedback (Shavelson et al., 2008). On the other hand, informal formative assessment can be any classroom interaction between teachers and students. These assessments may occur anytime during instruction and involve the whole class, small groups, or individual interactions (Ruiz-Primo, 2011). Informal formative assessments could be spontaneous and provide the teacher with information about a student's current level of understanding. While conducting these assessments, the teacher can address students' misconceptions and make immediate adjustments (Cizek et al., 2019).

Teachers' Beliefs of Formative Assessment

Several factors influence teachers' implementation of formative assessment. First, teachers' beliefs and attitudes influence the adoption of formative assessment (Clark, 2012; Coffey et al., 2011; Harrison, 2013; Heitink et al., 2016; Johnson et al., 2019). Teachers' positive beliefs of the usefulness and higher self-efficacy of formative assessment are positively related to the implementation of formative assessment (Karaman & Sahin, 2017; Yan & Cheng, 2015), while a lack of confidence will result in less implementation of formative assessment (Crichton & McDaid, 2016). Second, teacher's content and pedagogical knowledge impact the may hinder or promote the implementation of formative assessment (Heitink et al., 2016; Polizzi et al., 2015; Yin & Buck, 2019).Thus, targeted professional learning can positively impact the adoption of formative assessment **(**Rashid & Jaidin, 2014, Wyllie & Lyon, 2015 and limited training or professional development can be barriers for teachers to implement formative assessment (Poole, 2016; Vlachou, 2015). Third, school policies such as guidance on formative assessment (Elwood, 2006; Torrance, 2012; Van der Kleij et al., 2018), structures that support teachers' collaboration (Butt, 2010; Jones & Moreland, 2005; Leahy et al., 2005; McMillan, 2003) and standardized assessment and accountability can influence teachers' integration of formative assessment in instruction (Box et al., 2015; Yan & Brown,

2021; Yin & Buck, 2019) and class size can influence teachers' use of formative assessment (Alotaibi, 2019; Asare & Afriyie, 2023; Chin & Wong, 2013) and limited resources can hinder teachers' implementation of formative assessment (Alotaibi, 2019; Black & Wiliam, 2004; Halai et al., 2018).

Research Questions

Research Question One: What types of formative assessments do middle school mathematics teachers implement?

Research Question Two: What instructional decisions do middle school mathematics teachers make with data collected from formative assessment?

Research Question Three: What challenges do middle school mathematics teachers report implementing formative assessment?

Conclusions

Research Question One: What types of formative assessment do mathematics teachers use in their classrooms?

Based on the data collected, the teachers implemented a variety of formative assessment in their classrooms. First, ten (55%) teachers reported using questioning to check students' understanding, assess prior knowledge, and engage students in metacognition. Second, six (33%) teachers used observation as formative assessment strategy. In addition to questioning, four (22%) teachers reported using strategies to activate students' prior knowledge and review earlier content. Five (28%) teachers reported using technology tools as a formative assessment strategy. Eight (44%) teachers reported using practice problems as a formative assessment strategy. Four (22%) teachers reported using peer assessment during individual interviews. The teachers described how they used student monitors; these were student leaders in the group who worked as teacher "assistants. Moreover, teachers reported using peer-assessment strategies when they sent students to the board to complete practice problems. Six (33%) teachers reported sending students to the board regularly.

Research Question Two: What changes do teachers make from the formative assessment data collected?

During the individual interviews, seven (39%) teachers described using data from formative assessment to inform instruction. Teachers made on-the-spot adjustments while teaching. In addition, seven (39%) teachers reported using formative assessment to differentiate instruction and provide students with individualized support. a lesson not part of the curriculum. Three (17%) teachers described using formative assessment data to show students needing academic intervention in and outside the classroom. While some teachers provided students with individualized support during the lesson, other teachers involved the school administration and referred students for additional support. In addition, three (17%) teachers reported assigning grades to students from formative assessment learning tasks.

Research Question Three: What challenges do teachers face implementing formative assessment?

Five (28%) teachers reported students' lack of motivation for learning mathematics as a challenge for implementing formative assessment. This finding is consistent with research that has found that students' poor attitudes, excessive absenteeism, and mindsets can discourage teachers from implementing formative assessment (Remesal, 2007). Five (28%) teachers reported students' limited mathematics ability as a challenge. Furthermore, four (22%) teachers reported large class sizes as a challenge. Finally, **four** (22%) teachers mentioned that the unavailability of resources made it difficult to use different strategies for formative evaluation.

There are various implications of the findings of this research. First, there is a need for the creation of professional plans to support the implementation for formative assessment in mathematics. The plan could incorporate a variety of learning experiences such as workshops, coaching, inter-visitations, and lesson study. Teachers' pedagogical and content knowledge impact implementation of formative assessment (Heritage, 2007; Jones & Moreland, 2005). Collaborative structures such as professional learning communities have a positive impact on teachers' implementation of formative assessment (Butt, 2010; Gioka, 2009). Teachers' participation in professional learning has a positive impact in the adoption of formative assessment (Akayuure, 2021; Ramollo & Kanjee, 2023). Second, teachers should be provided with materials and supplies to implement formative assessment (Black & William, 2004; Dufresne et al., 2011). Third, workload. As a result, these teachers spent considerable time planning for their classes. Heavy workloads and large class sizes negatively affect teachers' implementation of formative assessment (Alotaibi, 2019; Asare & Afriyie, 2023).

Limitations

There were several limitations of this investigation. First, the sample size and setting of the study. The sample population consisted of 18 middle school mathematics teachers in seventh, eighth, and ninth grade from 16 schools. Second, the country's mathematics curriculum and instructional approaches might differ from those in other settings. These factors could limit the generalization of this study's findings (Polit & Beck, 2010; Treharne & Riggs, 2015). Third, teachers could have embellished their responses or provided inaccurate responses to the research questions. Finally, the data collection did not include classroom observations or analysis of student work. This type of data could have contributed to a more comprehensive understanding of teachers' formative assessment practices.

Recommendations

The findings of this study contributed to a gap in research about formative assessment practices in mathematics in the Dominican Republic. Future research could investigate teachers' formative assessment literacy and beliefs. Teachers' understanding and beliefs about formative assessment impact their integration of formative assessment (Harrison, 2013; Johnson et al., 2019). Additionally, preservice mathematics teachers' formative assessment could strengthen teachers' preparation programs and the implementation of formative assessment (Lachapell Maldonado, 2017; Morales-Lopez, 2017). Finally, other studies could explore the impact of specific formative assessment practices on student achievement, motivation, and attitude toward mathematics (Bennett, 2011; Leahy et al., 2005; Oswalt, 2013; William &Thompson, 2008).

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