World Academy of Science, Engineering and Technology
International Journal of Educational and Pedagogical Sciences
Vol:18, No:03, 2024

Teachers' Instructional Decisions When Teaching Geometric Transformations

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Abstract : Teachers' instructional decisions shape the structure and content of mathematics lessons and influence the mathematics that students are given the opportunity to learn. Therefore, it is important to better understand how teachers make instructional decisions and thus find new ways to help practicing and future teachers give their students a more effective and robust learning experience. Understanding the relationship between teachers' instructional decisions and their goals, resources, and orientations (beliefs) is important given the heightened focus on geometric transformations in the middle school mathematics curriculum. This work is significant as the development and support of current and future teachers need more effective ways to teach geometry to their students. The following research questions frame this study: (1) As middle school mathematics teachers plan and enact instruction related to teaching transformations, what thinking processes do they engage in to make decisions about teaching transformations with or without a coordinate system and (2) How do the goals, resources and orientations of these teachers impact their instructional decisions and reveal about their understanding of teaching transformations? Teachers and students alike struggle with understanding transformations; many teachers skip or hurriedly teach transformations at the end of the school year. However, transformations are an important mathematical topic as this topic supports students' understanding of geometric and spatial reasoning. Geometric transformations are a foundational concept in mathematics, not only for understanding congruence and similarity but for proofs, algebraic functions, and calculus etc. Geometric transformations also underpin the secondary mathematics curriculum, as features of transformations transfer to other areas of mathematics. Teachers' instructional decisions in terms of goals, orientations, and resources that support these instructional decisions were analyzed using open-coding. Open-coding is recognized as an initial first step in qualitative analysis, where comparisons are made, and preliminary categories are considered. Initial codes and categories from current research on teachers' thinking processes that are related to the decisions they make while planning and reflecting on the lessons were also noted. Surfacing ideas and additional themes common across teachers while seeking patterns, were compared and analyzed. Finally, attributes of teachers' goals, orientations and resources were identified in order to begin to build a picture of the reasoning behind their instructional decisions. These categories became the basis for the organization and conceptualization of the data. Preliminary results suggest that teachers often rely on their own orientations about teaching geometric transformations. These beliefs are underpinned by the teachers' own mathematical knowledge related to teaching transformations. When a teacher does not have a robust understanding of transformations, they are limited by this lack of knowledge. These shortcomings impact students' opportunities to learn, and thus disadvantage their own understanding of transformations. Teachers' goals are also limited by their paucity of knowledge regarding transformations, as these goals do not fully represent the range of comprehension a teacher needs to teach this topic well.

Keywords : coordinate plane, geometric transformations, instructional decisions, middle school mathematics
Conference Title : ICELS 2024 : International Conference on Education and Learning Sciences
Conference Location : Haifa, Israel
Conference Dates : March 11-12, 2024