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Development of preservice teachers' content knowledge in geometrical transformations: A teaching experiment

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Geometrical transformations is one of the basic learning domains of geometry and mathematics teachers' content knowledge has a big impact on construction of middle school students' knowledge in this context. For this reason, the purpose of this study was to research preservice mathematics teachers' content knowledge and to design a teaching process including an appropriate scaffolding tool to provide participants to shift from informal thinking to formal thinking on geometrical transformations. According to results it was revealed that acetate could be designed as an effective scaffolding tool for developing the view of “bijective function”, exploring relations, and making generalizations regarding the geometric transformations.

Keywords: Geometrical transformations, geometric habits of mind, preservice mathematics teachers.

INTRODUCTION

Unit of Geometrical Transformations, one of the basic learning domains of geometry, takes part in the Turkish Middle School Mathematics Curriculum including translation, reflection and rotation (MoNE, 2013). However, mathematics teachers’ content knowledge about geometrical transformations has a big impact on the construction of middle school students’ knowledge at this unit (Li, 2013). Starting from this point, we researched preservice mathematics teachers’ content knowledge on geometrical transformations and what kind of scaffolding tools and learning activities can be designed with intent to improve their knowledge in this context.

METHODOLOGY

In this study designed as a teaching experiment research, participants are 28 preservice teachers enrolled in elementary mathematics education undergraduate program at a public university from middle region of Turkey. Two participants, coded as Ayse and Fatma, were selected as focal participants who would attend to clinical interviews among 28 participants.

Teaching experiment and design of a scaffolding tool

According to data obtained from pre-clinical interviews, it was seen that participants explained transformations with informal words as “moving”, “folding” and they used trial-error strategies while solving problems. Starting from the constructivist approach, researchers discussed about appropriate learning tools that can provide participants to explore geometrical relations in transformations with informal experiments as “moving”, “folding” and “rotating” the materials. Finally researchers decided that an acetate can be used as a scaffolding tool presenting both physical movement and one to one correspondence of points in the context. In addition to this, geometry activities were designed according to Geometric Habits of Mind (Driscoll et al., 2007) and the teaching process focused on visualization of geometrical transformations, exploring “function” meaning of transformations, generalizing strategies and discovering relationships between reflection and perpendicular bisector as well as between rotation and circle (Figure 1).
RESULTS

During the posterior clinical interviews held, it was seen that the participants stated the role of “parameters” of geometric transformations within the context of “function”. In addition, the participants, in their strategies, referred to their generalizations based on the isosceles trapezoid, radius, chord and perpendicular bisector. According to results, preservice mathematics teachers’ content knowledge evolved from movement-based informal thinking to formal thinking in the context of geometrical transformations within teaching episodes including acetate mediated activities. Therefore it was seen that acetate could be designed as an effective scaffolding tool presenting both physical movement and one to one correspondence of points for developing the view of “bijective function”, exploring relations, and making generalizations regarding the geometrical transformations.

REFERENCES

