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Summary of Małgorzata Turczyńska's thesis "Supporting the development of selected components of mathematical culture of students in grades 1-3 of primary school using photography" written under the supervision of Prof. Marta Wrońska

Abstract

Teaching mathematics at the first stage of education is of paramount importance for a student's further education. It should provide young learners with the rudimentary knowledge and skills that serve as the foundation for more complex mathematical content introduced in subsequent years of schooling. Teaching and learning mathematics requires actively engaging with information that becomes the subject of cognitive activity. This process involves identifying and categorizing data within existing conceptual structures, as well as organizing fields of inquiry, research, and experimentation. Such a sequence of activities leads to detecting regularities, discovering patterns, constructing mathematical concepts, and solving problems through mathematical modeling[1]Unfortunately, when mathematics education becomes entangled in rigid school procedures, students' cognitive curiosity and the satisfaction derived from solving logical puzzles, using numbers, or devising original problem-solving strategies often disappear. Students stop asking questions, analyzing, and exploring the subject. This is a direct result of the lack of teacher-student dialogue during lessons, where children are merely provided with a ready-made set of mathematical concepts and instructional algorithms. Therefore, it is crucial for teachers to seek effective and engaging methods and forms of work tailored to the developmental abilities of early childhood students.

Consequently, the subject of this dissertation focuses on supporting the development of selected components of mathematical culture in students in grades 1–3 of primary school through photo-education, which can serve as a form of self-expression by interpreting the surrounding reality. Photographing objects related to mathematics allows children to see math in real-world spaces, enabling them to perceive numbers, shapes, symmetry, or patterns in nature, architecture, and everyday objects. This, in turn, can foster the development of mathematical thinking. Furthermore, photographing mathematics facilitates the integration of knowledge across various fields, such as mathematics, art, and technology. It also promotes learning-by-doing, which enhances the retention of mathematical concepts.

[1] S. Dylak, *Architektura wiedzy w szkole* [Architecture of Knowledge at School], Warszawa 2013, p. 55.

Math education cannot be limited to merely transmitting information and algorithms; it should actively lead to building a broadly understood mathematical culture in students. In this dissertation, selected components of the mathematical culture of primary school students in grades 1–3 were made the subject of empirical research. The study explored the relationships between mathematical photo-education and the development of selected elements of mathematical culture. The main research problem was formulated as follows: to what extent does the introduction of photo-education into the instructional process of mathematical education determine the development of selected elements of mathematical culture in students in grades I–III of primary school? The specific research problems, however, aimed to illustrate: to what extent do photo-education activities determine the level of students' mathematical proficiency in grades I–III of primary school? to what extent do activities utilizing mathematical photo-education shape the mathematical language of students in grades I–III of primary school? to what extent do activities utilizing mathematical photo-education shape the mathematical imagination of students in grades I–III of primary school? to what extent do activities utilizing mathematical photo-education determine the development of mathematical elegance in students in grades I–III of primary school? to what extent do activities utilizing mathematical photo-education determine the development of mathematical creativity in students in grades I–III of primary school? The diagnosis and assessment of the selected components of mathematical culture in primary school students in grades 1–3 were complemented by a pedagogical experiment conducted using the parallel groups technique. A significant stage of this experiment involved collaborating with early childhood education teachers to develop innovative lesson plans based on the concept of photo-education in mathematics originated by Professor Małgorzata Makiewicz[2].

The dissertation consists of five chapters. The first chapter describes in detail, among other topics, selected theories of mathematics didactics, as well as the issue of school readiness (maturity) in the context of difficulties and failures in learning the subject. It also presents instructional solutions that foster students' interests. The second chapter provides a detailed analysis of the phenomenon of mathematical culture and characterizes its individual components. It also introduces the didactic concept of mathematical photo-education as an innovative approach to teaching and learning mathematics that combines photography with various mathematical topics. The third chapter characterizes the education system and highlights its importance in the development of mathematical culture. It also analyzes the national core curriculum, which, as a vital systemic document, defines educational goals, content, and requirements, while directing the teacher’s work and student’s development. Its analysis demonstrated the significance of mathematics in the education of students in grades I–III within the process of building mathematical culture. This chapter concludes with a critical reflection on the current state of mathematics education implemented in kindergarten and early grades. The fourth chapter describes in detail the methodological

[2] M. Makiewicz, *O fotografii w edukacji matematycznej. Jak kształtować kulturę matematyczną uczniów* [On Photography in Mathematics Education. How to Shape Students' Mathematical Culture], Szczecin 2013.

assumptions of the author's own research. The final, fifth chapter provides a comprehensive analysis and interpretation of the results obtained during the empirical study. The issues addressed in this dissertation carry both cognitive and practical significance. The results obtained can serve as a foundation for further research on students' mathematical culture and can inspire teachers to seek new, more effective didactic solutions that support the development of children's mathematical competencies at the early childhood education stage. A detailed analysis of the results obtained from the conducted research and observations allows for the recommendation of mathematical photo-education as a valuable and permanent element of the instructional concept in early childhood education.

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