Summary of the Ph.D. Thesis
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The title of the thesis: ELEMENTS OF ANCIENT ART IN MATHEMATIC
EDUCATION OF TEENAGERS
Key words phrases: mathematic education, ancient art, teenager.

Summary

This doctoral dissertation ELEMENTS OF ANCIENT ART IN MATHEMATIC
EDUCATION OF TEENAGERS focuses on supporting the process of
mathematical education of teenagers through inspiration derived from
collections of ancient art. The thematic intention and its educational process is
based on the theory of multilateral education of Vincent Okoń. The research
revealed that the common space of mathematics and art represents an untapped
cognitive field and the mathematical education inspired by examples of ancient
art proves to be an excellent way to support student thinking development and
transfer from concrete operational thinking to abstract thinking based on formal
operations.

The dissertation consists of three parts: theoretical (chapter 1-4), methodological
(chapter 5), and empirical (chapter 6). The first chapter of the dissertation is
dedicated to presenting the theoretical foundations of mathematical education. It
addresses issues related to the goals of mathematical education, with particular
attention to the requirements and goals set for students in grades 7 and 8 of
primary school and grades 1 and 2 of secondary schools according to the *Core
Curriculum.* This chapter further outlines the mathematical education of
teenagers in contemporary Polish schools from a pedagogical perspective. An
analysis of creativity theories was conducted in this chapter. The interpretation
of the subject literature allowed for the recognition of different approaches to
creativity and the search for answers to the specific content of these theories of
practical nature for teenagers. The role of textbooks and books in the
mathematical education of teenagers was emphasized. Additionally, selected
pedagogical theories determining the premise of mathematical education were
discussed. The culmination of the considerations is the characteristic of didactic
concepts that integrate mathematical education with other areas of student
development.

The second chapter is dedicated to the presentation of the adolescence period,
which encompasses a series of changes occurring on a biological, psychological,
social, and cultural basis. A significant part of this chapter is devoted to the
characteristics of young people's difficulties in mathematical education and
mathematical abilities. 8

The third chapter of this dissertation contains information about ancient art. The culmination of the chapter is the presentation of the history and characteristics of a collection of replicas of ancient art sculptures from the Classical and Hellenistic periods, exhibited at the "Ancient Roots of Europe" exhibition at the National Museum in Szczecin. It is this collection of Heinrich Dohrn that served as inspiration for the implementation of the author's interdisciplinary educational project "Academy of Antiquity," which is described in the final subchapter.

The following fourth chapter presents sources of mathematical aesthetics in ancient art. Natural philosophers are introduced. A significant part of this chapter is devoted to the characteristics of Plato's vision of the world's structure and the postulate of the objectivity of beauty. The acceptance of the postulate of the objectivity of beauty led to the emergence of a canon. Additionally, the chapter includes essential information about proportions known as the golden ratio.

Chapter five presents the methodological assumptions of the author and the research plan. This part discusses the following: research subject and objectives, the adopted research issues, the applied methods, techniques, and research tools, variables, and indicators. The research procedure mainly employed survey method, analysis of products, textual analysis, and standard statistical analysis methods. The study involved 60 participants, with 30 students selected for the study. The panel of judges consisted of 50 mathematics teachers, 8 academic lecturers, and 2 university students.

In the empirical section, which constitutes the sixth chapter of the doctoral dissertation, a report on the executed research plan, as well as the conclusions and discussion of the results are presented. The results of the conducted research in relation to particular research problems are presented.

The results of the research process obtained through survey questionnaires, the original questionnaire – a test of mathematical interpretive expertise are subjected to statistical analysis. The results presented graphically (in tables or charts). The analysis of documents and products was carried out in accordance with the formulated research issues. Practical conclusions are formulated as recommendations and implications for educational practice. An important element of the dissertation is the concluding summary of the entire work, emphasizing the achievement of the main goal – to what extent the elements of ancient art referencing mathematical content in textbooks and literature on mathematical topics can be utilized, as well as the practical application of the research findings in pedagogy. Additionally, the final part of dissertation includes a list of references used, as well as a table of contents for tables, drawings, and images and the appendix