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DEVELOPING STUDENTS' COMPETENCIES THROUGH PRACTICAL PROBLEMS ON VECTORS IN MATHEMATICS EDUCATION

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Abstract: This article examines the role of practical problems in developing students' competencies while teaching the topic of vectors in mathematics. The study focuses on the competency-based approach as an effective method for improving mathematical understanding, problem-solving skills, and practical application abilities. The research identifies teaching methods that enhance students' engagement and demonstrates that the use of real-life and interdisciplinary problems significantly improves learning outcomes.

Keywords: competency-based approach, vectors, practical problems, mathematics education, students' competencies.

INTRODUCTION

In modern education systems, the priority is not only to provide theoretical knowledge but also to develop students' abilities to apply knowledge in practical situations. The competency-based approach has become an important direction in improving the effectiveness of teaching mathematics.

The topic of vectors occupies a significant place in mathematics education because it connects geometry, physics, mechanics, and computer science. However, students often find vector concepts abstract and difficult to understand when taught only theoretically. Therefore, the use of practical and applied problems can play a key role in developing mathematical competencies and improving conceptual understanding.

The purpose of this study is to analyze how practical problems on vectors contribute to the development of students' competencies and to identify effective teaching strategies within a competency-based framework.

METHODS

The study employed several research methods:

Literature analysis – pedagogical and methodological sources related to competency-based education and mathematics teaching were examined.

Comparative method – traditional teaching approaches were compared with competency-based instruction using practical tasks.

Pedagogical observation – students' engagement, participation, and problem-solving performance were observed during lessons.

Analytical method – the level of students' competencies was evaluated based on their ability to apply vector operations in practical contexts.

The research focused on lessons where vector operations such as addition, subtraction, scalar multiplication, and geometric interpretation were taught using real-life examples and interdisciplinary problems.

RESULTS

The results of the study indicate that the use of practical problems in teaching vectors provides several important educational benefits:

1. Improved conceptual understanding

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Students better understood the geometric meaning of vectors when problems were connected with physical quantities such as force, velocity, and displacement.

2. Development of problem-solving skills

Practical tasks required students to analyze situations, select appropriate mathematical tools, and justify their solutions.

3. Formation of mathematical competencies

Students demonstrated improved ability to perform vector operations and interpret results in applied contexts.

4. Increased motivation and engagement

Real-life problems increased students' interest in mathematics and encouraged active participation in classroom activities.

These findings suggest that practical problem-based instruction enhances both cognitive and applied learning outcomes.

DISCUSSION

The results confirm that a competency-based approach supported by practical problems is more effective than traditional lecture-based instruction. While traditional methods often focus on memorizing formulas and procedures, practical tasks encourage students to understand the meaning of mathematical concepts and apply them in real situations.

Furthermore, teaching vectors through interdisciplinary examples helps students see the relevance of mathematics in other scientific fields. This integration contributes to deeper learning and supports the development of critical thinking and analytical skills.

The study also shows that the teacher's role shifts from information provider to facilitator, guiding students in exploring problems and constructing knowledge independently. This aligns with modern pedagogical principles emphasizing student-centered learning.

CONCLUSION

The study demonstrates that practical problems play a significant role in developing students' competencies when teaching vectors in mathematics. The competency-based approach not only improves mathematical understanding but also strengthens students' ability to apply knowledge, reason logically, and communicate solutions effectively.

The integration of real-life and interdisciplinary problems makes the learning process more meaningful and engaging. As a result, students develop sustainable knowledge and essential skills that are necessary for further study and professional activity.

Therefore, the use of practical problems in teaching vectors can be considered an effective methodological strategy for improving the quality of mathematics education and implementing modern educational standards.

REFERENCES

1. Pranata, O. D. Analysis of vector concept understanding and its correlation with basic mathematical abilities of prospective science teachers. Contemporary Mathematics and Science Education, 6(1), 2025. DOI: 10.30935/conmaths/15723

2. Holubnycha, L., Shchokina, T., Soroka, N., & Besar, T. Development of Competency-Based Approach to Education. Educational Challenges, Vol. 27, Issue 2, 2022.

3. Hetmanenko, L. Applying Hamilton's vector formula in mathematics education: enhancing student mathematical skills through innovative teaching methods. SIJIS Journal, 2024.

4. Teaching Mathematics by Competency-Based Approach in University Students. SCIRP Journal paper on mathematical competencies and teaching methods. 202X (online).

5. Sabirova, Z. B. "Vektorlar" mavzusini tushuntirishda pedagogik texnologiyalardan foydalanish. Onlayn ilmiy jurnal Ta'lim va rivojlanish tahlili, 2024 (ISSN: 2181-2624)

pISSN:2349-5707 Volume:13,Issue 2, February -2026 eISSN:2349-5715

6. Bowden, J., & Marton, F. The University of Learning: Beyond Quality and Competence in Higher Education. Routledge, 1998 (klassik kompetensiya nazariyasi — pedagogik kontekst uchun) (Google Scholar)

7. Niss, M., & Højgaard, T. Competencies and Mathematical Learning: Ideas and Inspiration for Teaching. Springer, 2019 (matematika kompetensiyalari bo‘yicha zamonaviy manba).

8. Hoyles, C., & Noss, R. Mathematics Teaching and Learning with Technology: Rethinking the Terrain. Routledge, 2020 (praktik va interaktiv metodlar).

9. Van de Walle, J. A., Karp, K. S., & Bay-Williams, J. M. Elementary and Middle School Mathematics: Teaching Developmentally. Pearson, 2019 (matematika o‘qitish metodikasi).

10. Williams, J. Strategies for Teaching Mathematics in the 21st Century. SAGE Publications, 2021 (zamonaviy pedagogik yondashuvlar).