

A MODEL FOR DEVELOPING MATHEMATICAL VOCABULARY BASED ON THE ENGLISH LANGUAGE FOR PRIMARY SCHOOL STUDENTS

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Abstract

This article explores a model for developing mathematical vocabulary in primary school students through the English language. Particular attention is given to the innovative MALITLA model (Mathematics, Assessment, Literacy, and Language), which integrates mathematics learning, language development, assessment, and academic literacy. The study examines the impact of language competence on students' mathematical achievement and highlights effective pedagogical strategies for developing mathematical terminology. The findings indicate that integrating language and content enhances learning outcomes, supports cognitive development, and promotes active student engagement.

Keywords: Mathematical vocabulary, primary education, English language, MALITLA, integrated learning, language competence, mathematical terminology, cognitive development, academic literacy.

Introduction

Аннотация

В данной статье рассматривается модель формирования математического словаря у учащихся начальных классов на основе английского языка. Особое внимание уделяется инновационной модели MALITLA (Mathematics, Assessment, Literacy, and Language), которая интегрирует обучение математике, языку, оцениванию и академической грамотности. В



статье анализируется влияние языковой компетенции на усвоение математических знаний, а также раскрываются эффективные педагогические стратегии развития математической терминологии у учащихся. Результаты исследования показывают, что интеграция языка и содержания способствует повышению качества обучения, развитию когнитивных навыков и формированию активной учебной деятельности учащихся.

Ключевые слова: математический словарь, начальное образование, английский язык, MALITLA, интегрированное обучение, языковая компетенция, математическая терминология, когнитивное развитие, академическая грамотность.

In modern education, mathematics lessons are no longer merely a process of memorizing formulas. Instead, they should be structured as a process that engages students in active thinking, explaining, reasoning, and problem-solving. Therefore, the focus of instructional design should not be on lectures, but on interactive tasks, discussions, case studies, game elements, as well as visual and practical activities. Such an approach accommodates different learning styles (visual, auditory, and kinesthetic), connects abstract mathematical concepts with real-life situations, and transforms students from passive listeners into active participants.

The MALITLA model (Mathematics, Assessment, Literacy, and Language) examined in this study is an innovative educational model based on an interdisciplinary approach that integrates mathematics assessment, literacy, and language learning. The development of this model was grounded in research conducted at the intersection of various disciplines, particularly studies focusing on the relationship between mathematics assessment and language competence. For example, a classic study conducted by Abedi and Lord demonstrated that reducing the linguistic complexity of mathematics test items has a significant impact on students' performance. The researchers revised 20 questions from the NAEP (National Assessment of Educational Progress) standard test in the United States by simplifying their language. As a result, test scores improved across all groups of students, including English learners (ELs).



This finding indicates that simplifying the linguistic aspects of mathematical terminology enables students to better understand the content of mathematical problems and arrive at correct solutions. The study also revealed that students' language proficiency is a reliable predictor of their performance in mathematics assessments, not only for second-language learners but also for students who experience difficulties in mathematics.

Similarly, Vukovic and Lesaux also investigated the impact of language proficiency on mathematics achievement. Their four-year longitudinal study involved children aged 6 to 9 from linguistically and ethnically diverse backgrounds, including English learners (ELs) from low-income urban areas. The results of the study showed that language proficiency is an important factor in mathematics achievement; however, its influence varies across different areas of mathematics. In particular, language skills were found to improve students' performance in data analysis, probability, and geometry.¹ However, they had little significant effect on arithmetic and algebraic expressions, that is, tasks involving symbolic representation. In other words, symbolic mathematical knowledge is less dependent on language proficiency, as it is expressed through universal mathematical symbols.

Nevertheless, the general consensus in the scientific literature is that language proficiency has a direct impact on children's ability to understand mathematical content, analyze it, and establish logical connections. In other words, the better students understand mathematical terminology, vocabulary, and linguistic expressions, the more fully they are able to comprehend mathematical content.

As a result, these studies demonstrate that there is a strong cognitive relationship between mathematics and language; by developing language skills, it is also possible to strengthen students' mathematical thinking. Therefore, the MALITLA model views language learning as an integrated component of mathematics instruction and identifies language competence as a key factor in improving students' mathematical performance.²

Numerous studies in the field of language learning have shown that vocabulary development strategies significantly help learners acquire academic language

¹ McKeown, M. G., Beck, I. L. Vocabulary development: From word meanings to academic language // Elementary School Journal. – 2014. – Vol. 115(1). – P. 50–68.

² Olson, A., Chun, H., & Madigan, T. Supporting English learners in mathematics classrooms: A formative assessment approach. – San Francisco: WestEd, 2009. – 86 p.



proficiency.³ Through such strategies, students can more easily learn new words, understand their meanings more deeply, and improve their ability to use them in various contexts.

In the literature on mathematics education, it is emphasized that subject-specific linguistic skills—particularly the accurate understanding and use of mathematical terminology—are more effective in developing mathematical knowledge than general language skills. When students understand the meaning of mathematical terms, they are also able to grasp the logic behind formulas and symbols, which strengthens their conceptual thinking.

For learners of English, the level of mathematical understanding and thinking improves when teachers use repetition, explanatory instruction, active use of terminology, and clear and coherent speech. Repetition allows students to consolidate new vocabulary, while explanation and elaboration help connect concepts to real-life examples. Encouraging students to use terminology themselves promotes active communication, and the teacher's precise and well-structured speech facilitates comprehension. The MALITLA model has been developed based on this theoretical foundation, with the aim of reducing the gap between mathematics learning and language acquisition for multilingual learners. The MALITLA model incorporates modern pedagogical practices that are effective in supporting language development. These approaches serve to integrate language learning, literacy, and mathematical thinking. The model consists of four main components, each aimed at ensuring active student participation in the learning process and enhancing their language use competence.

1. Gradual Release of Responsibility

In this approach, the teacher initially takes the leading role in the learning process and then gradually transfers responsibility to the student. This process helps develop students' skills in independent thinking, problem-solving, and applying their knowledge in practice. The teacher first models the task, then performs it collaboratively with the students, and finally allows the students to work independently.

³ Сайфиддинова, Н. CLIL технологияси асосида бошланғич таълимда математика ва чет тили интеграцияси // Педагогика ва психология ж. – 2023. – №2. – Б. 57–65.



2. Use of Vocabulary Development Strategies

This component involves the application of specific word-learning strategies to strengthen students' academic language proficiency. By explaining mathematical terms in context, using them in both oral and written activities, and creating word maps or semantic networks, students gain a deeper understanding of terminology.

3. Translanguaging-Based Mathematics.

In this approach, students use both their native language and a second language to discuss mathematical concepts. Through listening and speaking, they are able to clearly express their ideas and achieve a deeper understanding of the concepts. The process includes elements such as repetition, elaboration, and the active use of mathematical terminology. This method activates students' cognitive processes and enhances their ability to use mathematical language effectively.

4. Integration of Listening, Speaking, Reading, and Writing through Authentic Learning Activities. In the teaching process, students are provided with opportunities to express their ideas in natural language across all types of activities. For example, they may read mathematical texts, explain problems orally, present calculations in written form, or engage in pair discussions. Such an approach prepares students to use language in real-life situations and makes the learning process more meaningful.⁴

In conclusion, the development of mathematical vocabulary based on the English language for primary school students is one of the important directions of modern education. The MALITLA model examined in this study contributes to deepening students' knowledge through the integration of mathematics, language, assessment, and literacy. This model once again confirms the significant role of language competence in understanding mathematical concepts. The conscious acquisition of mathematical terminology enables students not only to understand problems correctly but also to analyze them, explain their reasoning, and justify their solutions.

Furthermore, the approaches applied within the MALITLA model—such as the gradual release of responsibility, vocabulary development strategies,

⁴ Pearson, P. D., Gallagher, M. G. The instruction of reading comprehension // Contemporary Educational Psychology. – 1983. – Vol. 8(3). – P. 317–344.



translanguaging, and authentic learning activities—support the integrated development of students’ language and mathematical competences. This, in turn, increases students’ engagement in the learning process and helps shape them into independent thinkers. Overall, the model of developing mathematical vocabulary through the English language serves as an important pedagogical approach that supports students’ cognitive development, improves the effectiveness of education, and fosters competitive, multilingual individuals in line with modern educational demands.

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