THE IMPORTANCE AND ROLE OF MATHEMATICAL EDUCATION FOR MATHEMATICS TEACHERS

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Abstract: The significance and function of teachers, recognized as a crucial element in the quality of the educational process, have consistently garnered the interest of numerous scholars and have been extensively explored through both theoretical frameworks and empirical studies across various disciplines, including pedagogy. Given the wide array of challenges present in the teaching landscape, the roles of educators and their instructional methods are examined in diverse contexts, such as the age of students, levels of academic achievement, types of educational institutions, subjects taught, teaching strategies, and instructional formats. This study specifically investigates the role of mathematics teachers in relation to student performance in this subject area. The research aims to identify the practices of teachers who effectively fulfill their professional responsibilities in key aspects of teaching activities, including the organization and execution of lessons, fostering student motivation and interest in mathematical concepts, and facilitating quality communication and interaction between teachers and students. Additionally, the study seeks to explore the relationship between these practices and the level of student success in mathematics education.

Keywords: Teachers' role, Teaching of Mathematics; Planning, Preparation of teaching, Mathematics encourages.

1.0 Introduction

Mathematics is a term commonly encountered across various social contexts. As a subject, it fosters logical reasoning in students, thereby enhancing their skills and preparing them for specific career paths. Mathematics encourages a methodical approach to problem-solving, which is essential for wise decision-making. It deserves appreciation for its logical structure and the challenges it presents, inviting diverse methods of engagement. Everyone has the potential to learn mathematics, as it underpins all human activities. It is a core subject in high schools and many colleges, highlighting its critical role in education and personal development. The importance of mathematics extends beyond academics; it plays a significant role in shaping individual character. The objectives and tasks associated with mathematics education are clearly defined, particularly in primary schools, where the focus is on developing foundational mathematical and language skills. The effectiveness of teaching is significantly influenced by the pedagogical skills of the teacher and the classroom environment they cultivate, which are reflections of their personality. A teacher's behavior can greatly impact how students perceive them, especially at a young age, where their influence is most pronounced. The teacher's personality leaves a lasting impression on their students. It is essential for educators to be clear, approachable, honest, consistent, and straightforward in their interactions with students. The aim of this thesis is to explore each of these characteristics and their effects on the quality of teaching. The traits mentioned are integral to the profile of a successful mathematics teacher, each possessing unique qualities that require time, nurturing, and education. Patience is vital in developing children into moral, creative individuals with high self-esteem, who are well-educated and possess a positive outlook on their surroundings and the world at large.

2.0 The importance of mathematical education

Mathematics holds significant relevance in contemporary society, impacting both individual lives and global social dynamics (Bourdieu and Wacquant, 1992; Mackay, 2007). The origins and evolution of mathematics were primarily driven by practical necessities. In its formative stages, mathematical innovations facilitated various measurements and calculations essential for crafts, agriculture, construction, and calendar computations. As civilization progressed and literacy expanded across different social domains, mathematical literacy also advanced, fostering further scientific and civilizational growth (Boţic, 2002). In today's social development landscape, mathematical knowledge is crucial across all areas of human endeavor. Some scholars (Woodrow, 2003; Keitel, 2006) argue that learning and teaching mathematics are vital components of a society's economic success. Recognizing the significance of mathematical knowledge in the modern era has led to increased calls

for enhancements in mathematics education in several developed nations. Woodrow (2003) emphasizes this perspective, describing mathematics as the "language of science," suggesting that it serves as a foundation for technological understanding. Beyond its role in advancing modern science and information technology, mathematics has simultaneously evolved as a discipline. The advent of computers has given rise to entirely new mathematical fields, including programming for mathematical and logical problems, specialized computer languages, and process modeling. Additionally, various mathematical theories and operations have emerged, with probability theory, information and control theory, and game theory being among the most notable. In contemporary research, virtually every scientific discipline incorporates mathematical principles to enhance the understanding of its subject matter. Some scholars argue that mathematics is now being applied in fields where it was previously either absent or of minimal importance. Notable examples include biology, geology, linguistics, sociology, and various medical sciences (Charanchi, 2011: 17; Kascelan, 2001, 48). In the realms of medicine and biology, mathematical innovations are instrumental in a wide array of studies related to genetics, inheritance, development, metabolism, and fatigue, among others. Furthermore, mathematics has gained a prominent role in the social sciences, a shift that was not observed in the past. Through various mathematical techniques, including statistical analysis, researchers conduct both quantitative and qualitative assessments of social realities, addressing issues within diverse social phenomena and relationships (Cebic, 2000, 58). Consequently, mathematics has become an integral aspect of life and culture, evolving into a discipline that is essential for navigating the complexities of the modern world.

3.0 Mathematics as a science and a subject

Effective organization and execution of mathematics instruction necessitates that educators possess a comprehensive understanding of mathematics and its interrelations within a broader framework. This requirement encompasses a solid grasp of key mathematical domains as a discipline, thorough knowledge of mathematics as a subject, insight into the connection between mathematics as a field of study and its pedagogical approaches, as well as an appreciation for the distinctive characteristics and nuances of mathematics education. A fundamental question that arises in this context is: what exactly is mathematics, and what does it encompass? Providing a definitive answer to this inquiry is challenging. In fact, there remains no universally accepted definition of mathematics today. One contributing factor to this ambiguity is the multitude of criteria that various scholars have employed to characterize mathematics as a scientific discipline. For instance, D'Alembert and Grassmann (as cited in Spijunovic and Maricic, 2016: 45), drawing from the original Latin meaning of the term "mathematics" (Mathema - the science of quantities), defined it as the study of the properties of quantities, focusing on the relationships between sizes and spatial forms. This interpretation of mathematics was rooted in tangible quantities and their interactions in the real world. Nevertheless, it is important to acknowledge that mathematics also examines quantities in an abstract manner. No other field has achieved such a level of abstraction regarding qualitative properties as mathematics has, resulting in a variety of definitions that categorize mathematics as an abstract science. The literature presents a perspective that mathematics is a discipline focused on the study of quantitative relationships and spatial forms, which are abstracted from reality in a direct sense (Spijunovic and Maricic, 2016: 46). This implies that mathematics investigates abstract concepts derived from generalizations of real-world phenomena (Vukovic, 1996). Dejic and Mihajlović [1] address the challenge of precisely defining mathematics and determining its scope of study, attributing this complexity to the evolving nature of mathematics as a science. They argue that the focus of mathematical study has shifted over time. For instance, in ancient civilizations such as Egypt, China, Babylon, and India, the primary focus was on arithmetic, making it appropriate to characterize mathematics of that era as the science of numbers. Conversely, the ancient Greeks concentrated on geometry, exploring numbers through geometric principles. During their time, mathematics could be viewed as the study of numbers and geometric figures. The introduction of Descartes' analytical geometry, along with Newton's and Leibniz's advancements in differential and integral calculus, transformed the essence and focus of mathematics. This new approach centered on concepts of movement and change, ushering in an era characterized by variables. Consequently, mathematics can now be defined as a field that encompasses the study of numbers, shapes, movement, change, spatial structures, algorithm theory, programming, and more. This evolution indicates that mathematics is not static; rather, it is a dynamic discipline where concepts build upon one another, continuously evolving, and thus no definition of mathematics should be regarded as definitive.

4.0 Goals and tasks of teaching mathematics in subject teaching

The instruction of mathematics in primary education is shaped by the curriculum content, objectives, and tasks that align with the developmental capabilities of students at that age. As outlined in the rulebook for the seventh-grade curriculum (Official Gazette of RS-Education Gazette "No. 6/2009, 3/2011; Rulebook 8/2013"), the aims of mathematics education encompass several key areas: fostering fundamental language and mathematical literacy while guiding students toward achieving established educational standards; equipping students to tackle problems and tasks in unfamiliar contexts; encouraging them to articulate and justify their viewpoints and engage in discussions; nurturing a passion for learning and interest in the subject matter; imparting essential

knowledge for comprehending natural and societal phenomena; preparing students to utilize their mathematical skills in practical life situations; supporting their continued education in mathematics and self-directed learning; and contributing to the enhancement of cognitive abilities, the development of a scientific worldview, and the holistic growth of the student's character. The rulebook further specifies that the objectives of mathematics instruction are detailed through a variety of general and specific teaching tasks. The primary objectives of mathematics education include: providing diverse opportunities to effectively achieve the aims, objectives, and tasks of education, alongside the specific goals of mathematics instruction through various content and instructional methods; enabling students to gain the knowledge essential for comprehending quantitative and spatial relationships and principles across different natural, societal, and everyday contexts; fostering a foundational mathematical culture that is crucial for understanding the significance and application of mathematics in various human endeavors, including mathematical modeling, to facilitate further education and professional engagement; enhancing students' abilities in observation, as well as in logical, critical, analytical, and abstract reasoning; cultivating students' cultural, work-related, ethical, and aesthetic values while stimulating their curiosity in mathematics; developing the capacity to articulate thoughts using mathematical language with clarity and precision in both written and spoken forms; learning fundamental concepts related to sets, relations, and mappings; mastering essential operations involving natural, integer, rational, and real numbers, along with understanding the key characteristics of these operations; familiarizing students with significant geometric entities such as lines, shapes, and solids, and comprehending their interrelations; training students to achieve accuracy in measurement, drawing, and geometric constructions; preparing students to grasp relevant concepts in natural and technical sciences; and nurturing positive personality traits in students, including systematic thinking, perseverance, precision, organization, objectivity, self-discipline, and a sense of autonomy in their work; as well as developing habits and skills for utilizing various knowledge sources.

5.0 Specifics of mathematics teaching and the professional role of teachers

The instruction of mathematics encompasses several unique aspects that necessitate teachers' full dedication and involvement across all teaching dimensions. Key characteristics of mathematics instruction include: the abstract nature of mathematical concepts, the specialized language of mathematics, the cultivation of mathematical reasoning, a high degree of student engagement during lessons, and the essential continuity, gradual progression, and systematic approach required for mastering mathematical content. Mathematical abstractness is frequently highlighted in academic discussions as a significant characteristic of mathematics education (Bogutovac, 2008; Charanchi, 2011; Frenzel et al., 2006; Ćebić, 200, Romano, 2009). Etymologically, "abstract" refers to a phenomenon or object that is not directly perceivable and is distinct from immediate, tangible reality. "Abstraction," on the other hand, describes the cognitive process of deriving what is abstract, imagined, or generalized by isolating essential characteristics from irrelevant attributes of specific objects, phenomena, or qualities (Trebješanin, 2011: 40). This cognitive process fosters the development of abstract thinking, which transcends mere perception and concrete experiences, engaging with abstract concepts, general ideas, and symbols

6.0 The language of mathematics

Mathematics is not only abstract but also possesses a unique language of its own (Barwell, 2013; Fagan, 2005; Kilpatrick and Swafford, 2002; Kurnik, 2006; Naziev, 2015; O'Halloran, 2005). Language plays a crucial role across all scientific disciplines, serving as one of the four foundational elements of any science, as it encompasses the specific concepts and terminology pertinent to that field. In mathematics, this linguistic specificity is evident in its reliance on various symbols and notations that convey mathematical ideas more effectively than spoken language. These symbols are universal, allowing individuals to grasp mathematical concepts regardless of their linguistic background. The importance of mathematical language in education is particularly highlighted by the aforementioned abstraction in mathematics. The concepts and entities studied in mathematics are predominantly abstract, making them challenging to comprehend or articulate without the appropriate mathematical language. It is essential to emphasize that the nature of mathematics as a discipline necessitates that educators maintain strict adherence to mathematical language. Failure to do so can lead to misunderstandings of mathematical concepts, hindering students' learning progress. Furthermore, the responsibilities of mathematics teachers encompass the organization, planning, preparation, and execution of lessons. Effective organization of any educational activity is widely recognized as vital for successful implementation and achieving optimal results while minimizing the use of resources such as time, energy, and effort. Before delving deeper into the effectiveness of teachers' roles in organizing mathematics instruction, it is important to clarify the meaning of the term "organization."

7.0 Planning and preparation of mathematics classes in accordance with the principles of teaching

The foundational guidelines and concepts that inform the teaching, preparation, and execution of mathematics are encapsulated in the didactic and methodological principles. These teaching principles are established based

on the demands of societal development, the objectives and tasks of education, as well as the characteristics and capabilities of students in acquiring knowledge and developing relevant skills. Beyond their theoretical framework, didactic principles hold practical significance, aiding educators in making informed decisions regarding instructional strategies during the planning and delivery of lessons. However, despite their critical role in education, the pedagogical literature does not present a universally accepted number of teaching principles. This lack of consensus arises from various factors, including the diversity of teaching practices, the evolving nature of the educational process, and differing interpretations among didacticians and methodologists regarding the relationship between teaching laws, principles, and rules. The challenge in determining a precise count of teaching principles is further complicated by the obsolescence of some principles and the emergence of new, relevant ones. Additionally, the application of one didactic principle often satisfies the criteria of others, highlighting their intricate interconnections and dependencies. While this paper does not aim to delve into the classification issues or the exact number of teaching principles, it is essential to focus on those principles that frequently appear in existing classifications and are crucial for the planning and execution of mathematics instruction. Notable examples include: (1) the principle of scientific rigor; (2) the principle of age-appropriate teaching tailored to student abilities; and (3) the principle of individualization.

8.0 Planning and preparation of mathematics teaching harmonized according to the types of classes

A key factor in ensuring an effective teaching process in mathematics is the strategic planning of lessons based on their various types. Classes serve as the fundamental structure for organizing school activities, facilitating the achievement of educational, developmental, and practical objectives. Didactic literature presents several criteria for categorizing class types, with the class objective, teaching resources, instructional methods, and teaching tasks being the most frequently highlighted (Vilotijević, 1999; Dašić, 2008; Kurnik, 2007). Authors often discuss lesson typology, as this approach can shape and constrain teachers' practices, potentially limiting their autonomy and creativity in the classroom (Kurnik, 2007: 99). Nonetheless, class classification is beneficial because it acknowledges that teaching is a structured and organized endeavor; excessive freedom in lesson design and planning may lead to more adverse outcomes than favorable ones. Some scholars argue that class classification is essential for providing diverse options in lesson planning and organization, serving as a counterbalance to the pursuit of a one-size-fits-all approach to lesson organization. Others contend that class classification enhances opportunities for improving teaching practices and advancing the methodology of mathematics instruction (Kurnik, 2007; Prodanović and Ničković, 1998; Vilotijević, 1999). The most widely accepted classification in didactic and methodological literature identifies the following types of mathematics classes: (1) class for introducing new teaching material; (2) class for consolidating the teaching material; and (3) class for assessing the learned material.

9.0 Conclusion

This paper highlights the critical role of teachers in achieving quality education and enhancing student success, which remains a vital area of academic inquiry. However, research specifically addressing the role of mathematics teachers in the upper grades of primary education is notably limited. The rapid advancements in science, technology, and engineering have drawn the attention of researchers and professionals to the significance of mathematics education in developed nations. As a result, a substantial number of scholarly articles have emerged in international literature, exploring various challenges associated with learning mathematics. These studies often concentrate on specific actions taken by individual teachers, including the organization of lessons, student involvement in planning educational activities, methods of presenting instructional materials, strategies for fostering motivation, addressing difficulties in engaging certain students, utilizing mathematics quizzes to enhance motivation, communication practices in mathematics instruction, mathematical anxiety, collaborative teaching methods, discursive approaches in mathematics, the relationship between mathematics competitions and the development of quality interactive relationships, and the integration of computers and the Internet in mathematics education. These examples underscore the necessity for a more in-depth examination of the challenges faced in mathematics learning. In our country, there remains a lack of substantial research focused on the organization and execution of mathematics instruction in the upper grades of primary school. While some studies address the role of teachers and broader teaching challenges, they often do not specifically target the teaching of mathematics or the issues faced by older primary school students in this subject area. Considering the research findings and the importance of learning, further investigation is warranted.

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