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Research Perspectives of Initial Geometry Education

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Abstract

Depending on instructional methodologies, cultural circumstances, and educational philosophies, there might be differences in viewpoints regarding the first geometry education. Nonetheless, when teaching geometry at the early stages of education, educators frequently take into account a few common themes and factors. Start with actual, concrete experiences and work your way up to more abstract ones. This enables pupils to progressively construct a conceptual structure for comprehending geometry. Students' comprehension can be improved and their awareness of the interdisciplinary nature of information can be seen when geometry is integrated with other courses like science, literature, and the arts.

Keywords: geometry, science, literature, arts.

1. Introduction

Villani (1998), analyzing the perspectives of teaching geometry in the twenty-first century, makes it clear in the International Commission on Mathematical Instruction (ICMI) study that teaching geometry in primary schools should go beyond simply introducing mathematical concepts and procedures. Instead, it should assist students in developing their spatial reasoning skills and, particularly in their early education, in measuring length, surface, and volume.

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Vol 10, Issuse. 3 Sep 2019

Even though computer tools are an option, exercises involving the use of a protractor, compasses, and ruler are always preferable. According to Manturov, Solncev, Sorkin, and Fedin (1969), the eminent Russian mathematician Lobachevsky (N. I. Lobachevsky, 1792–1856) highlighted the significance of the mathematics education methodology. Manturov and his colleagues were the ones who, in nine points, gave the key ideas a prominent place in the approach of teaching mathematics. We shall discuss the ideas that are directly relevant to our research in this paper. The initial notion is that of a boundary value, which serves as the foundation for the subsequent concepts of derivatives, integrals, and measuring geometric quantities such as length, surface, and volume. The second idea is helping kids learn how to represent objects and how they relate to each other in space, which leads to the development of abstract thought in them. The goal of creating a nice

Teaching geometry shouldn't be limited to two-dimensional forms. Furthermore, it ought to address more than just the "micro-space" found on a worksheet or textbook page. Conversely, though. The foundation of early geometry instruction should be a close examination of the surrounding three-dimensional world. Eventually, as children get older, they should be able to observe three-dimensional situations in addition to other activities. One such activity would be to focus on the connection between the three-dimensional space and its two-dimensional plane representation.

We thought that the topics of space and spatial reasoning, as well as teaching strategies, real environments, learning through (re)discovering mathematical ideas, the role of textbooks in the initial mathematics education, and other related topics, should be included as key issues in geometry education, keeping in mind the current needs in the field. Thus, this study provides a broad understanding of why we must address these issues.

2. Location and Location-Based Reasoning

Developing the capacity to understand information linked to figures and visual

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Vol 10, Issuse. 3 Sep 2019

processing—also known as spatial visualization—as well as an awareness of spatial shapes, features, and their relationships—also known as spatial orientation—are some of the objectives of teaching geometry. According to Clements and Battista (1992), there are two spatial aspects in geometry: spatial orientation and spatial visualization/observation. There are reasons for each of these two elements. While spatial visualization/observation refers to the capacity to comprehend and visualize the effects of changes, that is, of (imaginary) movement of objects from a two- and three-dimensional space, spatial orientation refers to the ability to spot the position of an object in relation to other objects, such as navigating one's way through a building. Thus, it requires comprehension, interpretant.

The two spatial elements that are suggested below are thought to be especially crucial for teaching mathematics. The first is the capacity to decipher information pertaining to figures, which involves comprehending the visual aid and emerging vocabulary. The ability to manipulate and translate visual representations and images, as well as the ability to translate abstract relationships into visual representation, is the second.

3. Instructional Strategies

Over the past 20 years, there have been two approaches to evaluating student achievement (Kuzmanović & Pavlović Babić, 2011). Formative assessment, also known as evaluation in the service of learning, and standardized knowledge testing both seek to gather information that will help educational authorities in the formulation of educational policies. As a result, domestic testing is conducted, with the degree to which educational criteria are met being assessed.

The learning methodologies that emerged in the middle of the 20th century provided a conceptual framework for creating fresh approaches, or models, to assess student performance. Thus, learning is a complex cognitive activity, and knowledge acquisition cannot be reduced to the accumulation of factual information and routine procedures; rather, it implies the ability to integrate a variety of knowledge, skills, and procedures in ways that facilitate effective problem solving This is in line with the cognitive theory. Students' active

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www.ijsem.org
Vol 10, Issuse. 3 Sep 2019

knowledge construction, which is predicated on their comprehension of and ability to connect newly acquired knowledge with previously learned knowledge, is one of the basic tenets of the cognitive theory.

Regardless of the amount and kind of education a person receives, mathematical knowledge is now a necessary component of any modern organized education. The application of mathematics, the mathematical way of thinking, and the various ways to acquire mathematical knowledge that are applied in daily life are all topics of increasing discussion. These topics can be applied directly or indirectly in a variety of contexts. In addition to being vitally significant for an individual's intellectual growth, mathematical knowledge and abilities are also crucial for the technical advancement of modern society. They are applied in many real-world scenarios and daily life.

International research on student accomplishment is crucial for improved planning and implementation of relevant adjustments within the educational system. According to research by Dindyal, Cai, and colleagues, the international TIMSS and PISA studies' decision to provide mathematics a lot of space demonstrates the value of teaching mathematics to all members of society. The importance of their function is growing, and more and more nations are taking part in this kind of study. For Serbia's modern society, it is therefore vital to examine the official reports of these studies on student achievement in mathematics from both a mathematical and methodological perspective.

3.1Teaching Realistic Mathematics

The consequences of various teaching philosophies might be crucial foundational material for mathematics education. A teaching strategy utilized in the early geometry classroom that sparked a lot of research interest was founded on Freudenthal's (1905–1990) didactic phenomenology and the idea of mathematical education, as well as the "real environment."

when Freudenthal suggested relating mathematics to everyday circumstances that affect kids and are pertinent to society.

3.2 The Continued Work of Freudenthals

Learning mathematics should not be

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www.ijsem.org
Vol 10, Issuse. 3 Sep 2019

limited to memorizing a set of facts; rather, it should be a guided exploration of mathematical concepts with the ultimate goal of comprehending the mathematization process. Treffers and Freudenthal assert that there are two types of mathematization: vertical and horizontal. Through the use of a mathematical device that facilitates problem solving, one transitions from the actual world into the realm of mathematical symbols in horizontal mathematization. By creating links between mathematical procedures and concepts, vertical mathematization suggests both mobility within the realm of mathematical symbols and a restructuring of mathematical knowledge. Van van Heuvel-Panhuizen and Gravemeijer define context-specific challenges as those in which children see a problem scenario as experientially plausible and relatable. Because it promotes learning with comprehension, this method of instruction runs counter to the mechanistic approach to teaching. Models are crucial to the teaching of mathematics, and they have a special significance and function for RME students.

Unlike a mechanical method that focuses on practicing procedures, pupils who solve problems build a mathematical apparatus and comprehend mathematical concepts and procedures. The RME demands that learning be conceptualized in a sophisticated, meaningful way. In RME, students actively engage in the educational process, disclosing the mathematical concepts themselves, rather than just being passive recipients of information. Therefore, it can be concluded that the use of a context, the use of models, the active involvement of students in the learning process, the interactive nature of teaching, and the blending of various learning approaches are the fundamental elements of RME (Fauzan, 2002). Children can establish themselves through a variety of activities.

According to Freudenthal, mathematization comes from the "real environment" and not the other way around when it comes to contextual learning. The term "real" in mathematics education refers to the problem in its context, which, like mathematical difficulties, has a specific meaning for pupils who are searching for a solution. It is advised that problems with a

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www.ijsem.org
Vol 10, Issuse. 3 Sep 2019

contextual foundation be used to introduce even the most abstract mathematical concepts. Naturally, the textbooks and the teacher's work play a significant role in all of this. It is crucial to take into account their part in the educational process as a result.

It turns out that Freudenthal assigns us assignments to enhance the mathematics teaching process while accounting for the unique qualities of each student (age, mental, physical, and intellectual).

4. The Function of Textbooks

The efficiency of the planning and execution of mathematics instruction is one of the main concerns for both the didactic theory of mathematics and the practice of teaching. Many elements are considered, but some of the most often discussed (and examined) ones are the instructor's personality, the way that the lesson is organized, and the ways that the teacher interacts with the students.

The fact that calls for curriculum change are frequently the extent of educational reform speaks to the significance of the curriculum. According to Trebješanin the textbook is a fundamental, required school book that serves as a core teaching resource in the context of didactic theory. As a result, the textbook could have a significant influence on students' learning and growth. The purpose of the textbook is to aid in the process of accomplishing the socialization, developmental, and instructional objectives of formal education. According to Van den Heuvel-Panhuizen, the textbook is one of the main reformer bearers in the nations that have very good mathematics education, whereas the teaching methodology used is the "real environment" approach.

Since textbooks must be equally clear and understandable to teachers and students, textbook authors are expected to avoid accumulation in their preparation of texts and to be more selective in choosing the portions to be interrelated. They should also exercise caution while creating connections between the texts. Last but not least, the old didactic tradition recommends appropriate professional literature for the majority of innovative topics in the form of teacher handbooks (which are already produced in some countries) and special publications meant for students and future teachers to aid in their training while studying the subject teaching methodology.

5. Inspiration to Learn

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Vol 10, Issuse. 3 Sep 2019

According to Woolfolk, the only way to motivate a student to learn and participate in intellectual activities is to create a cognitive conflict—that is, to put the student in a position where they are aware of their current intellectual status and their desired status. The learner is thus given the opportunity to impromptu increase, improve, connect, and upgrade his or her knowledge.

He goals of learning with understanding which Skemp discussed is seen to be significantly aided by both internal and external motivation for mathematics learning. How to get most pupils interested in geometry and to perform better in this area of mathematics is a real question. A reevaluation of the primary objectives of geometry education in schools is imperative. Nonetheless, it is evident from their structure and content that the primary objective of teaching geometry, including its beginning education, in school textbooks and through traditional methods is to foster in students a logical thinking process. However, this proves to be unattainable at an early educational stage.

There was also a distinct teaching model seen. Problem situations are used to introduce new concepts. Problematization is a method of learning new material or refining already-known material at a higher level. It enables students to learn on their own, frequently under the guidance of their lecturers' suggestions, counsel, etc. Students gain an understanding and comprehension of the mathematical process in this way.

Textbooks serve as a framework (context) for the placement of mathematical requirements because they frequently include material that is connected to the child's experience as well as ideas and information from other courses. There's a discernible attempt to fit as many tasks into a practical life setting as possible. Sometimes, though, these efforts prove to be ineffective.

6. Conclusion

Studies that concentrate on methods of instruction for teaching basic mathematics, particularly those that draw on "real-life" experiences. The effects on student achievement and motivation for learning have been tracked in an empirical research of the "real environment" teaching strategy, which was bolstered by a suitable new model of early mathematics teaching textbooks. Since the "real environment" is not excluded from the classic teaching approach, students in the first three years of elementary school were not included in the survey. Conversely, it includes it as the fundamental source from which

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www.ijsem.org
Vol 10, Issuse. 3 Sep 2019

mathematical notions are formed. Students become older as they get become "detached" from the "actual environment" as a source of notions and "accustomed" to the world of abstract ideas

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