MATHEMATICS EDUCATION'S FUTURE: AN EXPLORATION OF THE NEW DIRECTIONS

Abstract

The COVID-19 outbreak has changed the objectives for mathematics instruction. Mathematical philosophy and the usage of digital technology have changed the way that young people think. Important problems include how mathematics teaching should be delivered in the twenty-first century. What are the key ideas in mathematics that today's kids need to comprehend, and why do we teach them? How can mathematics in the classroom be made interesting and useful? How can governments change mathematics education to ensure future economic competitiveness? Researcher went over these test questions and report findings in this article. And, the researcher also discussed about the difficulties in the real world context.

Keywords: mathematics, economic competitiveness, exploration.

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I. INTRODUCTION

“Why is education important? What connections exist between society and education? How are we aware? These are the fundamental issues in educational philosophy. There have been working groups on the philosophy of mathematics education for more than 20 years (Bicudo & Garnica, 2001). Why do we learn? The question “How do we know? Discussion forums on psychology of mathematics education have also discussed issues related to epistemology, or the idea of knowledge. As they look for the theoretical underpinnings of mathematics education and discuss how it is articulated in the classroom, the research that is developed about it, and its “return” to practical settings - like the classroom - which have been put on hold for many months by the corona virus pandemic. Many authors have written about classrooms, schools, and the products made there. For instance, Villarreal and Borba (2010) have demonstrated how collectives of humans and artifacts have developed mathematics throughout the field’s history. After the epidemic, the applications of digital technologies have altered youthful brains.

II. WHAT STUDENTS NEED TO LEARN ABOUT MATHEMATICS TODAY

The usage of mathematics is one of the oldest justifications for teaching it. In the past, people’s daily lives required them to be able to execute basic mathematical calculations. With the rapid advancement of technology, it is less necessary to be proficient in mathematical calculations now since we have instruments available to us that can perform such calculations. Today, the focus is less on the actual substance of mathematics and more on the abilities that are acquired via working on it.

III. HOW TO MAKE MATHEMATICSFUN AND APPLICABLE

Students frequently become stuck in mathematics studies in ways that don’t happen in history or language arts, such being unable to figure out a problem or forgetting the next step in an equation. The practice of “getting stuck” in mathematics lessons produces highly transferrable abilities. What do you do specifically when you are stuck on a problem, or how do you explain to someone else what you’ve done with an equation so far and what you believe would be the next step? The process of working through mathematical information aids kids in developing soft skills like problem solving, resilience, and communication, as mentioned in the prior question and response. This offers an added advantage. It’s also crucial to introduce pupils to interesting mathematics concepts, like infinity or zero. Mathematics is far more engaging when it is taught as a problem-solving activity rather than a series of monotonous exercises because students have an intrinsic love of riddles.

The type of mathematics skills required in the technology industry has changed as a result of technological advancements like advanced computing, artificial intelligence, and machine learning. The technology sector is not only looking for workers with a strong mathematical background who can perform analytics or develop algorithms, but also for workers with strong interpersonal, communication, and reasoning skills. Businesses want personnel who are capable of both product development and client education. Employers place equal value on numerical prowess and soft skills.

IV. WHAT SHOULD 21ST CENTURY MATHEMATICS TEACHING LOOK LIKE?

Students who get mathematics instruction that is solely content-based are not prepared for the current digitalization or the vast amounts of data that are available to us. Mathematics is a component of that, and mathematics instructors need to consider how they are educating their pupils to deal with problems they may encounter as adults. There are speedier and simpler ways for teachers to help students perform well in mathematics classes, such as by modeling a technique for them to replicate and memorise, but these methods rarely help students improve as problem solvers. In order to teach mathematics effectively in the twenty-first century, pupils need be given enough time to interact with and solve complicated mathematical issues. Mathematics instruction should focus on fewer, deeper subjects rather than covering a wide range of topics at a superficial level so that students may apply their knowledge in new situations.

V. WHAT ARE THE BEST WAYS FOR GOVERNMENTS TO IMPLEMENT MATHEMATICS EDUCATION TO ENSURE FUTURE ECONOMIC COMPETITIVENESS?

Governments have a big impact on the curriculum and what children study. To recruit qualified teachers, governments must also make sure that teaching is a financially and intellectually rewarding profession. Governments occasionally sacrifice dependability for relevance, so they must have the guts and fortitude to take on the "protectors" of education, including parents, the government, and even teachers themselves. Teachers frequently instruct students in the manner in which they themselves were instructed and were instructed to instruct. Governments must offer teachers the necessary assistance so they can adapt to educational changes. Governments should exercise caution when deciding how to evaluate mathematics since exam systems have a significant impact on education and serve as signals about what is valued in education. Success in education now revolves less on imparting knowledge and more around giving pupils a solid compass for the future.

VI. A TROUBLE IN THE REAL WORLD

1. **Mathematical Reasoning:** In today's society, it is becoming more and more crucial to be able to reason rationally and express arguments in a persuasive manner. A well-defined object or idea may be studied or changed in a variety of ways utilizing "mathematical reasoning" in the study of mathematics to arrive at firm and enduring conclusions. Students discover in mathematics that they can arrive at conclusions that they can completely trust to be true in a variety of real-life settings with the right reasoning and assumptions. It is also crucial that these results are objective and do not require approval from a third party. Mathematical thinking is supported and given shape by at least six essential understandings. The importance of abstraction and symbolic representation; seeing mathematical structures and their regularities; recognizing functional relationships between quantities; using mathematical modeling as a lens onto the real world (e.g., those arising in the physical, biological, social, economic, and behavioral sciences); and understanding variation as the heart of mathematics are some of these key understandings.

2. **Quantity, Number Systems, and Their Algebraic qualities:** Number systems and the fundamental algebraic qualities they use are how the fundamental and ancient idea of quantity is conceptualized in mathematics. Due to their extraordinarily broad range of applications, these systems are essential for mathematical literacy. Understanding representational issues, such as how to switch between representations as geometric quantities, points on a number line, or symbols involving numerals, how number systems affect these representations, and how algebraic properties of these systems apply when interacting with them, is also crucial.

3. **Formulate:** According to the concept of mathematical literacy, the word formulate refers to the capacity of a person to perceive and pinpoint instances when mathematics may be used, after which they can provide a problem that has been given in a particular context a mathematical framework. People decide where they can extract the necessary mathematics to examine, set up, and solve problems when they formulate circumstances mathematically. The problems in the actual world are given mathematical structure, representations, and specificity when they are translated from the real world to the field of mathematics. They analyze the limits and presumptions in the issue and reason about them. In particular, this mathematical formulation of circumstances entails actions like the ones listed below:

   Identifying the mathematical aspects of a problem situated in a real-life context and identifying the significant variables; recognizing mathematical structure (including regularities, relationships and patterns) in problems or situations; simplifying a situation or problem in order to make it amenable to mathematical analysis; identifying constraints and assumptions behind any mathematical modelling and simplifications gleaned from the context; representing a situation mathematically, using appropriate variables, symbols, diagrams and standard models; representing a problem in a different way, including organising it according to mathematical concepts and making appropriate assumptions; understanding and explaining the relationships between the context-specific language of a problem and the symbolic and formal language needed to represent it mathematically; translating a problem into mathematical language or a representation; recognizing aspects of a problem that correspond with known problems or mathematical concepts, facts or procedures; using technology (such as a spreadsheet or the list facility on a graphing calculator) to portray a mathematical relationship inherent in a contextualized problem; and creating an ordered series of (step-by-step) instructions for solving problems.

   Applying mathematical concepts, facts, techniques, and reasoning to solve issues with mathematical formulations and arriving at mathematical conclusions is referred to as employing in the mathematical literacy definition. Individuals carry out the mathematical operations required to deduce results and discover a mathematical solution while applying mathematical ideas, facts, methods, and reasoning to solve issues. They build a model of the situation under consideration, find patterns, draw links between various mathematical constructs, and formulate mathematical arguments. This process of applying mathematical ideas, facts, methods, and reasoning specifically entails actions like conceiving and putting into practice methods for solving mathematical problems; using tools, including technology, to aid in finding precise or approximate solutions; applying mathematical facts, rules, algorithms, and structures when solving problems; manipulating numbers, graphical and statistical data, algebraic expressions and equations, and geometric representations; creating mathematical diagrams, graphs, and constructions; and extracting mathematical inferences

4. **Interpret and Evaluate:** The definition of mathematical literacy's usage of the verb "interpret" (and "evaluate") focuses on people's capacity to consider mathematical solutions, outcomes, or conclusions and interpret them in light of the initial real-world situation. This entails putting mathematical conclusions or justifications back into the context of the issue at hand and assessing whether the outcomes are reasonable and makes sense in that setting. The processes involved in this process of analyzing, applying, and assessing mathematical results specifically include the following: understanding how the real world affects the outcomes and calculations of a mathematical procedure or model in order to make contextual judgments about how the results should be adjusted or applied; articulating why a mathematical result or conclusion does or does not make sense given the context of a problem; evaluating the reasonableness of a mathematical solution in the context of a real-world problem;

5. **Content Knowledge:** Knowing the fundamentals of mathematics and being able to use that knowledge to solve problems that have a purpose and context are crucial for modern people. That is, humans must use specific mathematical knowledge and expertise in order to think mathematically, solve issues, and evaluate events in personal, vocational, social, and scientific settings. The following subject categories: change and relationships, space and shape, amount, and uncertainty and data describe the mathematical phenomena that underpin large groups of issues, the basic organization of mathematics, and the main strands of conventional school curriculum. For the assessment of the special attention, four subjects have been chosen. The mathematics subject categories have covered these topics before. Instead, the subjects of development phenomena (change and relationships), geometric approximation (space and form), computer simulations (quantity), and conditional decision making (uncertainty and data) need specific attention.

6. **Computer simulations:** Because the necessary mathematics is complicated or includes many components acting in the same system, it is difficult to solve some issues in statistics and mathematics. These issues are increasingly being addressed in the modern world via algorithmic mathematics-driven computer simulations. The fact that computer simulations are the primary focus of the quantity content category indicates that there is a large category of complicated issues in the context of the computer-based evaluation of mathematics. For instance, as part of the test item, students can assess budgeting and planning using computer simulations.

7. **Data and Uncertainty:** Uncertainty is a given in science, technology, and daily life. Therefore, uncertainty is a phenomenon at the core of the mathematical analysis of many issue situations, and approaches for data representation and description as well as the theory of probability and statistics has been developed to cope with it. Recognizing the role of variation in processes, having an understanding of how that variation is quantified, admitting uncertainty and mistake in measurement, and being aware of chance are all parts of the category of uncertainty and data content. Additionally, it entails formulating, analyzing, and assessing findings made in circumstances where ambiguity is a key factor. A major technique for describing and evaluating a huge range of characteristics of many parts of the world is quantification.

8. **Conditional decision-making:** The fact that this topic is the focus of the uncertainty and data content category indicates that students should be expected to understand how assumptions made when building a model impact the conclusions that can be drawn and that different assumptions/relationships may very well lead to a different conclusion.

9. **Change and links:** Change can take place inside systems of connected things or in situations where the elements are interacting with one another and both the natural and planned worlds show a variety of short-term and long-term links among objects and circumstances. These alterations frequently take place over time. Other times, modifications to one thing or amount affect modifications to another. These circumstances can either include continuous change or discontinuous change. Some connections have a lasting, or invariant, character. Understanding key forms of change and noticing when they occur is a necessary step in becoming more knowledgeable about change and relationships so that you can apply the right mathematical models to describe and forecast change. This entails describing the change and the relationships mathematically using the proper functions and equations, as well as constructing, interpreting, and converting between symbolic and graphical representations of relationships.

10. **Growth phenomena:** Understanding the risks posed by bacterial and influenza pandemics, as well as the threat posed by climate change, necessitates that people stop thinking in terms of linear connections and acknowledge the necessity for non-linear models that represent extremely rapid growth. Although linear correlations are frequently found and simple to perceive and comprehend, assuming linearity can occasionally be risky. Growth phenomena are the focus of the change and connections content category, however this does not imply that participants should have studied the exponential function and it is also not implied that the items will ask participants to demonstrate their understanding of the exponential function. Instead, there should be questions that require students to realise that not all development is linear and that nonlinear growth has a significant impact on how we interpret some circumstances.

11. **Contexts:** Using mathematics to address a problem presented in a context is a crucial component of mathematical literacy. The context is the area of a person's reality where the issues are situated. The environment in which a problem occurs is frequently a determining factor in the selection of acceptable mathematical techniques and representations. It is crucial to employ a wide range of circumstances.

12. **Personal:** Issues with a focus on one's own, family, or peer group are those that fall under the category of personal context. Food preparation, shopping, gaming, personal health, personal transportation, sports, travel, personal scheduling, and personal finances are just a few examples of personal contexts.

13. **Occupational:** Problems that fall within the occupational context category are those that are focused on the workplace. Measurement, costing, and ordering building supplies, payroll and accounting, quality control, scheduling and inventory, design and architecture, and job-related decision-making are just a few examples of the items that fall under the occupational category. Although PISA survey items must be accessible to 15-

year-old children, occupational contexts may pertain to any level of the workforce, from low-skilled jobs to the highest levels of professional work.

14. **Social:** Issues with a social context are those that pertain to one's community, whether it be local, national, or international. Voting systems, public transit, the government, public policy, demography, advertising, national statistics, and economics are just a few examples of the things that they could encompass. Despite the fact that people are personally involved in each of these items, the social context category concentrates on problems from the viewpoint of the community.

15. **Scientific:** Issues and themes pertaining to science and technology as well as the application of mathematics to the real world are included in the category of scientific problems. The universe of mathematics itself, as well as fields like meteorology or climatology, ecology, medicine, space science, genetics, and genetic engineering, is just a few examples of specific contexts. The scientific environment includes things that are intra-mathematical, meaning that every component involved is a part of the mathematical universe.

VII. CONCLUSION

There is a growing global interest in so-called 21st Century talents and their potential integration into educational institutions. The Future of Education and abilities: Education 2030 is a research initiative supported by the OECD that includes a magazine that focuses on these abilities. This international research of curriculum, including the inclusion of such abilities, involves over 25 nations. The project's core concern is the potential future structure of the curriculum, with an initial emphasis on mathematics. Critical thinking, creativity, investigation and inquiry, self-direction, initiative and perseverance, information usage, systems thinking, communication, and reflection are a few of the essential 21stCentury abilities.

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