Research Article

Contextual Invitations To Explore Mathematical Competencies Among Learners At Secondary Level

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ARTICLE INFO	ABSTRACT
	Contextual invitations are instructional strategies that connect Mathematical concepts to real-world scenarios, making learning more engaging, relevant, and meaningful for Secondary school students. By bridging the gap between abstract Mathematical concepts and concrete everyday experiences, contextual references can foster a deeper understanding of Mathematical principles and improve student's problem-solving abilities. Additionally, contextual invitations can increase student's motivation to learn Mathematics and improve their attitudes towards the subject. This paper aims to explore how contextual invitations provided in the Mathematics curriculum can enhance student's understanding of Mathematical concepts, improve their problem-solving skills, and increase their motivation to learn Mathematics. Data analysis shows that the Secondary Mathematics Curriculum placed a greater emphasis on scientific contexts than on social contexts, while the personal and occupational context remains zero. Additionally, contextual invitations can increase student's motivation to learn Mathematics and improve their attitudes towards the subject. The study suggests that curriculum should incorporate different contextual invitations for internalizing Mathematical concepts more engaging and effective.
	Key words: Contextual Invitations, Mathematical Competencies, Secondary Level

Introduction

A person's daily actions, from budgeting and money management to cooking and house renovation, are all based on Mathematics. It improves one's capacity for critical thought and problem-solving, empowering one to confidently negotiate challenging circumstances and reach well-informed conclusions. The foundational subjects of Mathematics, arithmetic and algebra serve as the building blocks for more complex ideas and real-world applications. For everyday problem-solving and numeracy, arithmetic—which includes addition, subtraction, multiplication, and division—is crucial. It serves as the cornerstone around which more intricate Mathematical concepts are built. However, algebra goes beyond these fundamental concepts to incorporate the representation of numbers and quantities in formulae and equations using symbols and characters. This abstraction allows for the generalization of Mathematical principles and the solving of equations, which is critical for advanced studies in Mathematics, science, and engineering. According to the National Council of Teachers of Mathematics (NCTM), proficiency in arithmetic and algebra is crucial for students' success in higher Mathematics and their ability to apply Mathematical reasoning in real-world contexts (NCTM, 2000). Mathematical Literacy is crucial not handiest for understanding and succeeding in arithmetic but additionally for navigating each day life with confidence and competence. It entails the capability to use Mathematical ideas, reasoning, and hassle-fixing competencies to interpret and analyze information, make selections, and solve practical problems. This literacy is important in diverse aspects of everyday life, including dealing with budget, knowledge records within the news, making knowledgeable purchaser choices, and even in fitness-associated selections. in step with the Programme for worldwide student assessment (PISA), Mathematical literacy is defined as "an man or woman's capability to formulate, rent, and interpret Mathematics in an expansion of contexts" (OECD, 2013). This talent set is more and more critical in

a international that relies closely on information and quantitative analysis, underscoring the need for sturdy Mathematical education to equip individuals with the tools essential for non-public and expert success.

PISA Framework for Mathematical Literacy

The three main components of the PISA framework for Mathematical Literacy are: the situations and contexts that problems are situated in and that serve as sources of stimulus material; the Mathematical content that various problems and questions relate to and that is arranged according to certain overarching ideas; and the Mathematical competencies that need to be engaged in order to make the connection between mathematics and the real world (where problems are generated) and then use that connection to solve the problems.

Situations and context

Engaging with Mathematics-using and performing it in a range of contexts-is a crucial component of Mathematical Literacy. Written materials that detailed a variety of problems that students might encounter and that called on them to use their Mathematical knowledge, comprehension, or skill to analyze and resolve were presented to the class. The PISA Mathematical Literacy framework defines four situations: scientific, public, educational/vocational, and personal. The degree to which each problem directly impacts students' lives—that is, the degree to which there is a close relationship between the student and the problem context—varies amongst the scenarios.

Mathematical Content

The four broad knowledge areas, or "overarching ideas," that make up the PISA framework's definition of Mathematical content are historically established branches of Mathematical thought that serve as the foundation for Mathematical curricula in educational institutions across the globe. When taken as a whole, these wide topic areas provide pupils with the breadth of Mathematics they require to build upon in life and to broaden their Mathematical horizons. The following four main content areas are as follows:

Space and shape: It refers to the geometry curriculum: finding parallels and contrasts, identifying shapes in various representations and dimensions, comprehending the characteristics of items and their relative placements, and figuring out how two- and three-dimensional visual representations relate to actual objects

Change and relationships: It has the strongest connection to the algebraic curriculum. identifying correlations between variables and considering relationships in algebraic, geometric, pictorial, symbolic, and tabular formats.

Quantity: It is the comprehension of relative scale, the identification of numerical patterns, and the representation of quantities and quantifiable characteristics of actual objects through the use of numbers (counting and measuring).

Uncertainty: The capacity to solve problems involving data and chance, which typically pertain to statistics and probability in school curriculum, is known as uncertainty.

Mathematical Competencies

The PISA framework for Mathematical Literacy examines and classifies the competencies into three clusters: the reproduction cluster, which deals with replicating learned information; the connections cluster, which expands on the reproduction cluster by utilizing problem-solving techniques to address unfamiliar but routine situations; and the reflection cluster, which deals with contemplating the method utilized or required to solve a problem.

Objective

To study the extent of contextual invitations in the Secondary School Mathematics Curriculum in order to explore Mathematical competencies among secondary school students

Method used

The investigator analyzed the 8th standard Mathematics textbook followed by SCERT, Kerala. Content evaluation became the method utilized by the investigator for this motive. The Mathematics textbook has 10 chapters beneath three parts. The chapters are illustrated with wide range possibilities for the inexperienced persons to dig out Mathematical additives in its natural and significant paperwork. The investigator analyzed four chapters under Arithmetic, Algebra and Statistics sections from Part II &III with a purpose to discover diverse contexts used in the illustration part as well as practice part. The contexts classified by PISA 2021as Personal, Societal, Occupational and Scientific are taken into consideration while analyzing the mathematics curriculum to explore contextual references for the effective internalization. The contextual references are tabulated and mentioned in detail underneath the heading Analysis and Discussions.

Analysis and Discussions
Based on the Analysis of the chapter " **Identities**" under Part II**,** number of contextual preferences cited under each domain is represented in Table I

Table 1: Number of problem references in each context in chapter "Identities"

Subtopics	Contexts			
	Personal	Occupational	Societal	Scientific
Product of sums				4
Square of a sum				5
Product of differences				3
Sum and difference				4
Total				16

This table shows that all of the questions in these subtopics; 4 on the product of sums, 5 on the square of sums, 3 on the product of differences, and 4 on the sum and difference—are designed to be used in scientific context. Although the chapter emphasizes more on scientific contexts, the absence of other three contexts namely social, professional, and personal settings highlights a major gap in linking these ideas to more extensive, practical applications. Furthermore, there is a chance that the contextual significance of identity-related issues will go unnoticed, which would hinder students' capacity to relate abstract ideas to practical situations. Insufficient contextualization could make it difficult for students to understand how identities are used in real-world and Mathematical contexts.
Based on the Analysis of the chapter " **Ratios**" under Part II**,** number of contextual preferences cited under each domain is represented in Table 2

Table 2: Number of problem references in each context in chapter "Ratios"

Subtopics	Contexts			
	Personal	Occupational	Societal	Scientific
Part relations			2	2
Changing relations			2	4
Three quantities			3	4
Total			7	10

The subtopics " Part Relations" (2 scientific issues, 2 societal problems), Changing Relations (2 societal difficulties, 4 scientific problems), and Three Quantities (3 societal problems, 4 scientific problems) emphasize the chapter's strengths and weaknesses, as this table demonstrates. These examples show how important Ratios are to comprehending and simulating scientific processes. The problems in "Part Relations" and "Three Quantities" highlight the social background and highlight the significance of Ratios in practical situations. Students can see through these examples how Mathematical ideas may be applied to resolve social and communal concerns. The chapter, however, is underrepresented in terms of personal and professional settings. Ratios are made more approachable and useful for everyday life when personal context problems are included. The problems in the professional setting show how useful ratios are in a variety of professions. Overall, even though the chapter does a good job of integrating societal and scientific contexts, adding personal and professional contexts would give pupils a more comprehensive knowledge of the significance and practical applications of Ratios in a variety of fields.
Based on the Analysis of the chapter " **Negative numbers**" under Part III**,** number of contextual preferences cited under each domain is represented in Table 3

Table. : 3 Number of problem references in each context in chapter " Negative numbers "

Subtopics	Contexts			
	Personal	Occupational	Societal	Scientific
Old sums				8
Negative speed				-
New sums and differences				2
Applications				2
New multiplication				4
Negative division				3
Total				19

The table shows that the majority of the problems are in the scientific environment, with an emphasis on using Negative numbers to comprehend and resolve scientific and Mathematical situations. But there are no problems in the personal, social, or professional contexts—all of which are essential for illustrating how Mathematical ideas can be applied more broadly to problems in society, the workplace, and daily life. Students may find it more difficult to understand Mathematics' applicability outside of academic and scientific contexts due to the lack of variety in contextual questions.

Based on the Analysis of the chapter " **Statistics**"   under Part III, number of contextual preferences mentioned under each domain is represented in Table 4

Table : 4 Number of problem references in each context in chapter "Statistics"

Subtopics	Contexts			
	Personal	Occupational	Societal	Scientific
Tabulation				3
Another form				2
A new picture				5
Total				10

A significant emphasis on the scientific context is revealed by the analysis of the Mathematical Literacy component, in the chapter Statistics. The subtopics that are displayed in tabular form consist of three scientifically contextualized problems; another form has two scientifically contextualized problems; and a new picture form has five scientifically contextualized problems. Personal, professional, and social contexts are still less motive for the conceptualisation of statistical components in its pure forms. More problems from these various contexts are inevitable to guarantee a well-rounded comprehension and use of statistical principles, giving students a more thorough and useful understanding of statistics in a variety of real-world scenarios.

Findings

Based on the context of Mathematical Literacy (personal, social, occupational, and scientific), an examination of the algebra and arithmetic and Statistics chapters, covering subjects such as identities, ratios, negative numbers, and statistics, indicates a notable emphasis on scientific context. Students' logical and analytical abilities can be strengthened by this emphasis on scientific challenges as they learn to apply Mathematical concepts to real-world scientific situations. This methodical approach contributes to the development of a solid foundation in Mathematical connections and functions, which is essential for higher scientific and technology courses.

The absence of problems in personal and professional contexts, however, can make it more difficult for students to make the connection between Mathematical ideas and their daily lives and future employment. In addition to being a tool for scientific research, Mathematics is a useful domain in many different vocations, personal finance, and decision-making. Students may find it difficult to understand the relevance of what they are learning without exposure to these settings, and they may not acquire the abilities needed to use Mathematical reasoning in real-world scenarios. Students who do not immediately perceive the application of Mathematics in their daily life may get disengaged and demotivated as a result of this disconnect.

Less emphasis is placed on social contexts in all these chapters under consideration; social problems are covered in only one chapter, which limits pupils' comprehension of mathematical elements towards society, which in turn leads to a huge difference in school mathematics and mathematics in the society. When it comes to tackling social concerns, mathematics is essential for comprehending public policy, economic trends, and demographic data analysis. The curriculum loses out an opportunity to raise students' knowledge of how Mathematics may be applied to address societal issues and promote local, national, and international well-being by not include more social context problems. A more interlinked contexts on social, professional, and personal settings with scientific ones would offer a comprehensive mathematics education and increase the subject's relevance and interest for interdisciplinary as well as multidisciplinary courses.

Conclusion

It is imperative that the problems provided in the Algebra and Arithmetic, Statistics sections of the 8th Standard Mathematics Curriculum incorporate a wide range of contexts, including personal, societal, occupational, and scientific. This all-encompassing method guarantees that students will not only understand mathematical ideas within a scientific context but also recognize how they are used in real-world situations, social concerns, and a variety of career domains. A well-rounded curriculum encourages more comprehension and involvement to inculcate critical thinking and problem-solving abilities in their workplace in the future.

Acknowledgement

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