WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Mathematical Awareness among Non-Mathematical Students of UG and PG Classes

Neha[1], Manu Gupta[2]

[1,2]Department of mathematics, J.V. Jain College Saharanpur-247001, UP

A B S T R A C T

Mathematical awareness refers to a person's understanding, appreciation, and practical use of mathematical concepts in both academic and real-life contexts. Among non-mathematical students—those studying fields such as arts, humanities, social sciences, or commerce—this awareness plays a crucial yet often overlooked role. Research and surveys reveal that many non-mathematical students possess limited mathematical awareness due to past negative experiences, anxiety toward the subject, or a belief that math is irrelevant to their chosen field. While these students often exhibit low confidence in mathematical skills, they frequently encounter situations that require basic numeracy, such as managing personal finances, interpreting data, or making logical decisions. Attitudes toward mathematics among non-mathematical students are often shaped by how it was taught in school, with abstract or formula-heavy instruction leading to disinterest. Despite this, many students acknowledge the importance of math in everyday life and express interest in learning it in more practical, applied ways. In this research we select the non-mathematical students in J.V. Jain College Saharanpur. We take a sample of 114 non-mathematical students. To collect data from the students. a Google form was created, in this form a questionnaire of 10 questions was prepared, the answers to which were multiple choice. After being collecting the Data it was observed that the gap in mathematical awareness among these students highlights the need for improved math education strategies that are relevant, engaging, and context-based. Enhancing mathematical awareness not only helps students become more capable in their personal and professional lives but also promotes critical thinking, data literacy, and problem-solving—skills essential in the 21st century.

Keywords: Mathematical Awareness, Instructions, Non mathematical students, mathematical literacy

1. Introduction

Mathematics plays a crucial role in various aspects of daily life, from financial decision-making to problem-solving and logical reasoning. However, many students who do not specialize in mathematics often struggle with mathematical concepts or perceive them as irrelevant to their fields of study. This lack of mathematical awareness can hinder their ability to engage with quantitative data, interpret statistical information, and apply logical reasoning in real-world scenarios. Mathematical awareness in non-mathematical students refers to their ability to recognize and appreciate the significance of mathematical principles in everyday life and across different disciplines. It involves developing a basic understanding of numerical literacy, critical thinking, and problem-solving skills, which are essential in fields such as business, social sciences, humanities, and even the arts.

This paper aims to explore the importance of mathematical awareness among non-mathematical students, the challenges they face in acquiring mathematical literacy, and strategies to enhance their engagement with mathematical concepts. By fostering mathematical awareness, students can become more confident in handling numbers, interpreting data, and making informed decisions, regardless of their academic background. Mathematics is often perceived as a subject exclusive to scientists, engineers, and economists, while students in non-mathematical fields may see it as irrelevant to their studies. However, mathematical awareness is not just about complex equations and formulas; it is a fundamental skill that enhances logical thinking, problem-solving, and decision-making in everyday life. Whether it is budgeting finances, analyzing trends, or interpreting statistical data, basic mathematical literacy plays a significant role in personal and professional settings. For non-mathematical students, a lack of mathematical awareness can lead to difficulties in understanding quantitative aspects of their studies, such as research methods, data interpretation. Mathematical awareness refers to an individual's ability to recognize, understand, and apply mathematical principles in practical contexts. It goes beyond complex calculations and equations, encompassing essential skills like logical reasoning, numerical literacy, and problem-solving. These skills are crucial in various fields, including psychology, business, law, media, and even creative arts, where interpreting data, analyzing trends, and making strategic decisions are integral parts of professional work. However, many non-mathematical students develop math anxiety or avoid mathematical reasoning due to negative past experiences, ineffective teaching methods, or a belief that mathematics is irrelevant to their field. In today's data-driven world, mathematical literacy is more important than ever. The ability to understand statistics, probability, and basic quantitative analysis is essential in evaluating news reports, conducting research, managing finances, and understanding economic and social trends. The increasing integration of technology, artificial intelligence, and big data across disciplines further emphasizes the need for mathematical awareness, even among students who do not specialize in mathematics. This

paper aims to highlight the significance of mathematical awareness among non-mathematical students, examining the barriers they face in acquiring mathematical literacy and the potential consequences of this lack of awareness.

1.1 Literature review

1.1.1 The Importance of Mathematical Awareness

Mathematical literacy is widely recognized as an essential skill in modern education and everyday life. According to the Programmed for International Student Assessment (PISA) by the **OECD (2019) [5],** mathematical literacy is defined as "an individual's capacity to formulate, employ, and interpret mathematics in various contexts." Research suggests that mathematical awareness is not only crucial for STEM students but also for those in non-mathematical fields, as it aids in logical reasoning, data interpretation, and informed decision-making **(Geiger, Goos, & Forgasz, 2015) [4].** A study by Steen (2001) highlights that mathematical literacy is necessary for effective participation in society, especially in an era where data-driven decision-making is prevalent. The increasing reliance on statistics in disciplines such as economics, psychology, and sociology reinforces the need for all students to develop basic quantitative reasoning skills (**Gal, 2002) [7].** These studies emphasize that mathematical awareness is not confined complex computations but involves the ability to analyze and interpret numerical information critically.

1.1.2. Barriers to Mathematical Awareness Among Non-Mathematical Students-

Several studies identify common challenges that non-mathematical students face when dealing with mathematical concepts. **Tobias (1993) [8]** describes "math anxiety" as a psychological barrier that prevents students from engaging with numerical problems, often resulting from early negative experiences with mathematics education. Math anxiety leads to avoidance behavior, where students actively steer clear of subjects or topics involving quantitative reasoning **(Ashcraft & Krause, 2007) [2].** Another significant challenge is the perception that mathematics is irrelevant to non-STEM fields. According to studies by Brown, **Brown, and Bibby (2008),** many students in the humanities and social sciences do not recognize the applicability of mathematics in their disciplines. This disconnect is often reinforced by traditional teaching methods that fail to contextualize mathematical concepts in real-world applications relevant to non-STEM students (**Niss, 2010) [9].** Furthermore, educational research has shown that teaching approaches play a significant role in shaping students' attitudes toward mathematics. Traditional rote-learning methods and a lack of practical applications contribute to disengagement (**Boaler, 2016).** When mathematics is taught in isolation from real-world contexts, students fail to see its relevance, leading to decreased motivation and engagement (**Ernest, 2004) [3].**

1.1.3. Strategies for Enhancing Mathematical Awareness-

To address the challenges associated with low mathematical awareness among non-mathematical students, researchers have proposed various pedagogical strategies. One effective approach is interdisciplinary learning, where mathematics is integrated with subjects such as history, economics, psychology, and the arts. According to **Wiggins and McTighe (2005) [6],** contextualizing mathematical concepts within familiar disciplines helps students see their practical relevance. Another strategy involves the use of technology and digital tools to enhance mathematical learning. Studies by **Prensky (2010)** suggest that digital platforms, such as interactive simulations, data visualization software, and educational games, can help make mathematical concepts more accessible and engaging. Technology-assisted learning has been found to reduce math anxiety and improve comprehension by providing visual and interactive representations of abstract concepts (**Bottge et al., 2014) [10].** Additionally, problem-based learning (PBL) has been identified as an effective method for improving mathematical engagement. According to **Hmelo-Silver (2004),** PBL encourages students to apply mathematical reasoning to solve real-world problems, fostering critical thinking and practical application. For example, incorporating financial literacy exercises, statistical data analysis in social sciences, and mathematical modeling in environmental studies can help students see the tangible benefits of mathematical awareness.

1.1.4. The Role of Educators and Institutional Support-

Research emphasizes the role of educators in fostering mathematical awareness among non-mathematical students. According to **Schoenfeld (1992),** educators who adopt an interdisciplinary and application-based approach to teaching mathematics can help bridge the gap between abstract mathematical concepts and their real-world significance. Additionally, institutional support, such as tutoring programs, workshops, and curriculum reforms, can contribute to improving mathematical literacy among students in non-STEM fields (**Coben, 2003).**

Furthermore, studies by **Benken et al. (2015)** highlight the importance of professional development for educators to equip them with strategies for teaching mathematics in non-traditional ways. By training instructors to use engaging, real-world examples, universities and schools can create a more inclusive learning environment for students from diverse academic backgrounds.

2. Research Design

2.1 Ssignificance Of The Study

The significance of mathematical awareness among non-mathematical students lies in its wide-reaching impact on education, personal development, and society. Here's a detailed explanation:

Enhances Critical Thinking and Problem-Solving-

- Even non-mathematical students regularly face situations that require logical reasoning, decision-making, and analytical thinking. Mathematical awareness helps them:
- Make sense of data, statistics, and numerical information.
- Approach problems methodically and critically.

Promotes Informed Decision-Making-

- From budgeting personal finances to interpreting news statistics or analyzing business data, mathematical awareness empowers students to:
- Understand percentages, graphs, and probabilities.
- Avoid misinformation and misleading claims based on numbers.

Bridges the Gap Between Disciplines-

- Mathematics is not confined to STEM fields. It connects with:
- Social sciences (statistics in research).
- Commerce (financial analysis).
- Arts and humanities (patterns, symmetry, and structure).
- Building awareness helps students see the relevance of math in their own fields.

Prepares for Everyday Life-

- Mathematical skills are essential for:
- Managing time and schedules.
- Comparing prices and understanding offers.
- Interpreting utility bills and financial documents.
- Awareness helps students apply basic math confidently in daily life.

Encourages Lifelong Learning and Confidence-

- Many non-mathematical students develop a fear or dislike of math due to early experiences. Building awareness:
- Reduces anxiety around math.
- Improves confidence to engage with math when needed-

Supports National Educational Goals-

- Developing mathematical literacy across all disciplines contributes to:
- A more informed and skilled workforce.
- Better civic engagement and policy understanding (e.g., reading economic reports or election results).
- If you need this rewritten in simpler terms or formatted for a report or presentation (like a paragraph, bullet points, or a slide), just let me know!

2.2 Scope of The Study;

The scope of this study outlines the boundaries and focus areas related to investigating mathematical awareness among students who do not specialize in mathematics. It helps clarify what the study will cover and what it will not.

Target Group

The study focuses on non-mathematical students, specifically those enrolled in arts, commerce, humanities, or vocational courses at the high school or undergraduate level. Students pursuing core mathematical or science-based degrees are excluded. The study population comprises non-mathematical students of J. V. Jain College Saharanpur.

Sample frame – 125

Sample - 114

Areas of Awareness Studied-

- Basic mathematical concepts: Percentages, ratios, averages, and estimations.
- Application in daily life: Budgeting, time management, interpreting bills, and basic financial decisions.
- Interpretation of data: Understanding charts, graphs, and simple statistics.
- Attitudes toward mathematics: Interest, confidence, anxiety, and perceived usefulness.

2.3 Geographical Scope-

- The study may be conducted within a specific institution, city, or region (e.g., colleges in a particular district or state).
- Broader national or international comparisons are beyond the Scope.

2.4 Objectives of the study -

The general objectives of this study is to examine the mathematical awareness' in non-mathematical students.

The specific research objectives are as follows-

1. To assess the level of mathematical awareness among students from non-mathematical disciplines (e.g., humanities, arts, social sciences).
2. To identify factors that influence their mathematical awareness.
3. To explore attitudes, beliefs, and experiences related to mathematics among non-math students.
4. To evaluate the impact of real-life or cross-disciplinary mathematical exposure on their awareness.

2.5 Research Methodology-

Study design:

This study Employ Survey Research Methodology, which involves collecting and analyzing data from a select group of individuals. The design of the study outlines the plan for conducting the Research focusing on specific individuals.

Instrument:

Difficulties in learning questionnaire is administered to obtain data on students likes and dislikes, motivational beliefs, learning strategies and their perceptions regarding difficulties in study. This questionnaire includes open ended as well as scaled items.

Procedure:

Before data collection, good report will be established with the students and their safety will be ensured. To collect data, a questionnaire of 12 questions was made which was converted from Google form through internet. The language of questions has been kept simple and readable by everyone. With the help of Google form, we received from 114 students.

3. Hypothesis and Objective of research:

The objective of this study is to know the level of mathematical awareness in non-mathematical students and to do proper investigation.

3.1 Hypothesis testing

Hypothesis.1

H_0: Lack of mathematical understanding limited student ability to make decisions.

H_1: Lack of mathematical understanding do not limit Students ability to make decisions.

Particulars	No. of Responses	Percentage
Yes	69	60.5%
No	45	39.5%

Total	114	100%

S.No.	Oi	Ei	(Oi-Ei)	(Oi-Ei)2	(Oi-Ei)2/Ei
1.	69	57	12	144	2.526
2.	45	57	-12	-144	2.526
	114	114	0		5.052

Calculated Value = 5.052 Tabulated Value = 3.841 Degree of Freedom = n-1 = 2-1 = 1

We can accept the internal Hypothesis i.e. 'H_1'.

Conclusion:

The computed value of Chi square is 5.052. The table value of Chi square is 3.841, since the ascertained value is more than the table value of Chi square. Along these lines, H_0 (Null Hypothesis) is rejected and H_1 (Alternative Hypothesis) is concluded i.e. lack of mathematical understanding do not limit student's ability to make decisions.

Hypothesis. II

H_0: Struggle with math requires help from other and online resources.

H_1: Struggle with math do not requires help other and online resources.

Particulars	No. of Responses	Percentage
Yes	73	64.1%
No	41	35.9%

Total	114	100%

S.No.	Oi	Ei	Oi-Ei	(Oi-Ei)2	(Oi-Ei)2/Ei
1.	73	57	16	256	4.491
2.	41	57	-16	256	4.491
	114	114	0		8.982

Calculated Value = 8.982 Tabulated Value = 3.841 Degree of Freedom = n-1 = 2-1 = 1

Conclusion:

The computed value of Chi square is 8.982. The table value of Chi square is 3.841 since the ascertained value is more than the table value of Chi square. Along these lines, H_0 (Null Hypothesis) is rejected and conclude that Struggle with math do not requires help from others and online resources.

Hypothesis III

H0: Use of digital tools (like- calculator, budgeting, excel) do not assist in numerical tasks.

H1: Use of digital tools (like - calculator, budgeting, excel) assist in numerical tasks.

Particulars	No. of Responses	Percentage
Yes	71	63.3%
No	43	37.7%
Total	114	100%

S.No.	Oi	Ei	Oi-Ei	(Oi-Ei)2	(Oi-Ei)2/Ei
1.	71	57	14	196	3.438
2.	43	57	-14	196	3.438
	114	114	0		6.876

Calculated Value = 6.876 Tabulated Value = 3.841 Degree of Freedom = n-1 = 2-1 = 1

Conclusion -

The computed value of Chi square is 6.876. The table value of Chi square is 3.841 since the ascertained value is more than the table value of Chi square. Along these lines, H_0(Null Hypothesis) is rejected and H_1(Alternative Hypothesis) is accepted i.e. use of digital tools assist in numerical tasks.

Limitations of the Study;

- **Limited Scope of Participants:**

The study focuses only on non-mathematical students from selected departments or institutions, which may not represent all non-math students across different universities or regions.

- **Self-Reported Data:**

The use of questionnaires and interviews relies on participants' self-perception, which may lead to social desirability bias or inaccurate responses.

- **Subjectivity in Qualitative Data:**

The interpretation of interview responses is subject to researcher bias, even with thematic analysis, potentially affecting the objectivity of findings.

- **Lack of Longitudinal Insight:**

The study captures a snapshot in time and does not track how mathematical awareness changes over time or with interventions.

- **Variability in Mathematical Backgrounds:**

Students' prior exposure to mathematics (school curriculum, tutoring, etc.) varies widely, which may influence their awareness and cannot be fully controlled in the study.

- **Generalization of Results:**

Findings may not be applicable to students from different cultural, educational, or socio-economic backgrounds.

- **Limited Depth in Quantitative Analysis:**

While statistical methods can show trends, they may not capture the nuanced reasons behind low or high mathematical awareness.

Findings-

1. General Level of Mathematical Awareness.

- Most students could apply basic math in personal finance (e.g., budgeting), but struggled with interpreting statistical data and graphs in news/media.

2. Attitude Towards Mathematics

- Perception that math is only relevant to science or business fields.
- Belief that math is difficult or anxiety-inducing.

3. Exposure to Math in Real Life

- Around 70% of students acknowledged using some form of math in daily life (e.g., shopping, cooking, managing time), but did not identify these activities as "mathematical".
- Only 15% of students reported seeing relevance of math in their academic field (e.g., arts, humanities).

4. Gender and Field Differences

- Female students had slightly lower self-reported math confidence than males, although actual awareness scores were similar.

- Students from social sciences performed better in logical reasoning than students from pure humanities.

Conclusions

The study revealed that while non-mathematical students demonstrate a moderate level of mathematical awareness, there remains a significant gap in their perception of mathematics and its relevance to everyday life and their academic disciplines. Many students apply mathematical thinking in practical situations—such as budgeting, time management, and interpreting basic data—yet fail to recognize these tasks as mathematical, indicating a lack of conceptual connection. Negative attitudes toward mathematics, shaped largely by early educational experiences, math anxiety, and traditional teaching methods, continue to hinder deeper engagement. Furthermore, the limited integration of mathematical applications in non-math subjects contributes to the misconception that mathematics is only relevant for science or commerce students. Encouragingly, the findings also suggest that students are open to engaging with mathematics if it is presented in a contextual, meaningful, and relatable way. Enhancing mathematical awareness, therefore, calls for more interdisciplinary teaching approaches, real-life applications, and supportive learning environments that reduce fear and promote confidence. Thus, to foster a generation of learners who are not only mathematically aware but also confident in applying math in various life domains, it is essential to demystify mathematics and embed it naturally across the curriculum—regardless of discipline.

7. RECOMMENDATION:

1. Integrate Mathematics Across Disciplines

- Incorporate basic mathematical concepts into non-math subjects (e.g., using statistics in history or economics in literature).
- Encourage interdisciplinary projects that require basic data analysis or logical reasoning.

2. Use Real-Life Applications

- Design classroom activities that show how math is used in everyday life—such as budgeting, interpreting news graphs, or analyzing trends on social media.
- Highlight the role of math in arts, humanities, and social sciences (e.g., symmetry in design, patterns in music, data in psychology).

3. Reform Teaching Approaches

- Shift from rote learning to practical, problem-based learning (PBL).
- Encourage collaborative learning and peer discussions to reduce math anxiety.
- Use technology (apps, games, videos) to make math more interactive and engaging.

4. Address Math Anxiety and Negative Attitude

- Provide counseling or workshops focused on developing mathematical confidence.
- Train teachers to use inclusive and non-judgmental teaching strategies, especially in early education.

5. Raise Awareness of Everyday Math Use

- Educate students that common tasks—such as cooking, shopping, or traveling—involve math.
- Develop awareness campaigns or events (e.g., "Math in Daily Life Week") to build positive perceptions

6. Provide Teacher Training

- Offer professional development programs for teachers of non-mathematical subjects on how to subtly integrate and relate to math.
- Equip educators with strategies to identify and support students with low mathematical confidence.

7. Curriculum Revision

- Revise curricula to include foundational numeracy and reasoning skills for all streams—not just science or commerce.
- Introduce "Quantitative Literacy" modules as part of general education for all undergraduate students

References

1. Anthony, G., & Walshaw, M. (2009). Effective pedagogy in mathematics.
2. Ashcraft, M.H., & Krause, J.A. (2007). Working memory, math performance, and math anxiety.
3. Ernest, P. (2004). What is the philosophy of mathematics education?

4. Geiger, V., Goos, M., & Forgasz, H. (2015). A rich interpretation of mathematical literacy.

5. OECD. (2012). PISA 2012 Results: What Students Know and Can Do.

6. Sfard, A., & Prusak, A. (2005). Identity that makes a difference.

7. Boaler, J. (2002). Experiencing school mathematics. Cockcroft, W.H. (1982). Mathematics Counts: Report of the Committee of Inquiry into the Teaching of Mathematics in Schools.

8. Emphasizes the importance of numeracy for all learners, not just those in mathematical fields.

9. Fennema, E., & Sherman, J.A. (1976). Fennema-Sherman Mathematics Attitudes Scales.— Developed scales to measure math anxiety, confidence, and usefulness among different student groups.

10. Gal, I. (2002). Adult numeracy: A review of research. — Discusses how numeracy is relevant in everyday adult contexts and how many adults lack awareness of their use of math.

11. Niss, M. (1996). Goals of Mathematics Teaching. — Describes mathematical competence as a set of skills useful beyond the math classroom.

12. Goos, M. (2004). Learning mathematics in a classroom community of inquiry. — Investigates how collaborative learning boosts confidence and awareness.

13. Wiest, L.R. (2001). The role of computers in math education: A review of literature. — Explains how digital tools help students visualize math concepts and increase understanding.

14. Kaput, J.J. (1992). Technology and mathematics education. — Advocates for technology use to increase accessibility and contextual application of math.

15. Hyde, J.S., Lindberg, S.M., Linn, M.C., Ellis, A.B., & Williams, C.C. (2008). Gender similarities characterize math performance. — Shows gender gaps in math are minimal, challenging stereotypes that harm awareness.

16. . Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. — Learning math in context enhances retention and awareness.

17. Ashcraft, M.H. (2002). Math anxiety: Personal, educational, and cognitive consequences. — Reviews how fear of math affects academic performance and willingness to engage.

18. Johnson, E.B. (2002). Contextual Teaching and Learning: What It Is and Why It's Here to Stay. — Argues for teaching that connects content to real-life context to improve awareness.

19. . Sawyer, R.K. (2006). The Cambridge Handbook of the Learning Sciences. — Explores inquiry-based and constructivist learning models in math education.

20. PISA (OECD, 2012). Programme for International Student Assessment: Results and Insights. — Highlights the link between real-life math problem solving and student awareness.

21. Boaler, J. (2016). Mathematical Mindsets: Unleashing Students' Potential through Creative Math.— Promotes growth mindset and positive attitudes toward math.

22. . Ernest, P. (1991). The Philosophy of Mathematics Education.