

AWARENESS AMONG STUDENTS ABOUT CONTRIBUTIONS OF ARYABHATA AND BRAHMAGUPTA IN MATHEMATICS

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Abstract:

This study investigates the level of awareness regarding Indian mathematical contributions among students using a survey-based research design. Indian mathematicians such as Aryabhata and Brahmagupta, made significant contributions to global mathematics, yet public awareness remains uncertain. While the ancient Indian scholars laid the foundation for essential concepts such as zero, trigonometry, and algebra. A structured questionnaire was distributed via Google Forms to 50 respondents. The findings indicate moderate awareness of basic concepts, but low awareness of advanced contributions. The study highlights a gap between curriculum exposure and conceptual understanding. It suggests the need for integrating Indian Knowledge Systems (IKS) into mathematics education to enhance conceptual awareness.

Keywords: *Indian Mathematics, Awareness, Survey Study, Aryabhata, Zero, IKS, Mathematics Education*

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Introduction: Indian mathematics has played a foundational role in the evolution of global mathematical thought. The development of the concept of zero and the decimal place value system is widely attributed to Indian scholars, particularly Brahmagupta (Joseph, 2011). Similarly, Aryabhata introduced early trigonometric concepts and astronomical calculations in his work *Aryabhatiya* (Katz, 2009).

Despite these contributions, several studies indicate that awareness of Indian mathematical heritage among students is limited and often restricted to textbook-level information.

In the context of the Indian Knowledge Systems (IKS) initiative, it becomes essential to assess how much students actually know about these contributions. Therefore, this study aims to evaluate awareness levels through a survey-based approach.

Needs and Importance of Study: In today's education system, even with the focus of the National Education Policy 2020 on holistic and culturally rooted learning, mathematics teaching often emphasizes exams over conceptual and historical understanding. This creates a need to improve students' awareness of India's mathematical heritage.

Indian scholars like Aryabhata and Brahmagupta made significant contributions such as zero and early algebra, yet students' knowledge is usually limited to basic textbook information. This shows a gap between what is taught and what is truly understood.

Therefore, it is important to study students' awareness levels and promote the integration of Indian Knowledge Systems (IKS) in mathematics education to make learning more meaningful and concept-based.

Statement of Research:

Title – Awareness among Students about Contributions of Aryabhata and Brahmagupta in Mathematics

This study is conducted among students to examine their level of awareness regarding the contributions of Aryabhata and Brahmagupta in mathematics. It focuses on understanding how well students are familiar with key concepts such as zero, the decimal system, algebra, and trigonometry developed by these scholars, and how effectively this knowledge is reflected in their learning.

Research Objectives:

1. To assess student's awareness of Aryabhata's contribution in mathematics
2. To assess student's awareness of Brahmagupta's contribution in mathematics
3. To evaluate understanding of key concepts (zero, algebra, trigonometry)

Scope and Limitations:

The study examines students' awareness of the mathematical contributions of Aryabhata and Brahmagupta, highlighting the need to connect historical knowledge with modern learning. It is important as it promotes deeper understanding, appreciation of India's mathematical heritage, and reduces rote learning.

However, the study is limited to a small group of students and focuses only on awareness, not detailed understanding. The findings may not be widely generalizable, and survey-based responses may include bias or inaccuracies.

Literature Review:

Gaurav Tekriwal (2021) The Great Indian Mathematicians:15 Pioneers Who Put Indian Mathematics on the World Map, Publisher –Puffin (Penguin Random House India)

It highlights pioneers like Aryabhata, Brahmagupta, and Srinivasa Ramanujan, explaining how their ideas shaped important concepts such as the number system, algebra, and advanced mathematics. The book also includes lesser-known mathematicians and shows India's rich mathematical heritage over thousands of years.

Kim Plofker (2009) Mathematics in India, Publisher – Princeton University Press

This book provides a detailed historical study of Indian mathematics, including the works of Aryabhata and Brahmagupta. It explains their mathematical methods, such as early trigonometry, algebraic rules, and astronomical calculations. The book helps readers understand how ancient Indian mathematicians contributed to global mathematics and why their work is important in educational awareness today.

Title – Contributions of Ancient Indian Mathematics

Author- Tushar Singh

Published in – Research Gate/ Academic Preprint

This paper explains the major contributions of Indian mathematicians like Aryabhata and Brahmagupta in developing concepts such as zero, trigonometry, algebra, and the decimal system. It highlights how these ideas influenced global mathematics and modern scientific development. The study helps in increasing awareness about India's rich mathematical heritage among learners and researcher.

Title – Aryabhata's Pioneer Contribution in Mathematics: The Father of Indian Mathematics

Author – Abul Basar et al

Published in - *International Journal of Statistics and Applied Mathematics* Stats & Maths Publications, India
International Journal of Statistics and Applied Mathematics (2024). This article focuses on the mathematical and astronomical contributions of Aryabhata, including his approximation of π , work on trigonometry, and astronomical calculations. It also connects his work with later developments by Brahmagupta and other Indian mathematicians. The paper emphasizes the importance of making students aware of these contributions to improve appreciation of mathematical history.

Research Gap:

Earlier studies mainly focus on the historical and mathematical contributions of Aryabhata and Brahmagupta and explain their role in the development of mathematics. However, the research do not study how much today's students are aware of these contributions.

In addition, the present study focuses on finding the **level of awareness among 50 students** and identifying gaps in their knowledge about these mathematicians.

Methodology:

For the present study, the researcher has used the **survey method**. Research is a systematic process of collecting, analyzing, and interpreting information. This survey method has helped in understanding the awareness and knowledge of respondents through questionnaires.

In this study, the students were assessed with a self-structured questionnaire awareness about the contributions of Aryabhata and Brahmagupta in mathematics. The data was collected from maths students and analyzed using simple statistical methods like percentage.

Thus, the survey method helped in understanding the level of awareness among students.

Population and Sample:

The Population of study includes maths students.

Sample: A sample of **50** was selected from different schools using a **random sampling technique** to ensure fair illustrative. The sample includes both male and female students from different academic backgrounds.

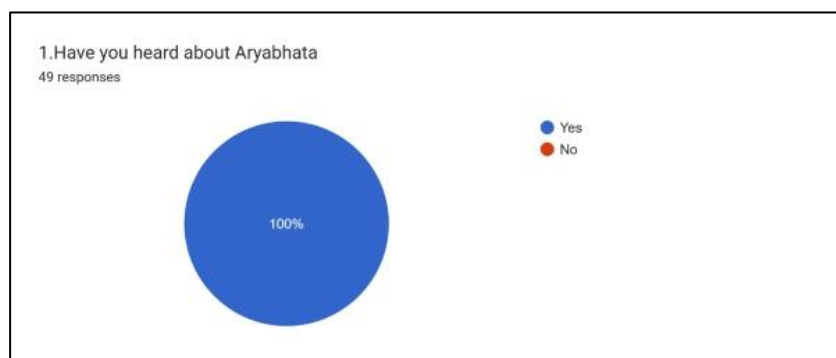
Data Collection Tool:

For the present study, a structured questionnaire was used for data collection. A questionnaire is a set of questions designed to collect information systematically from respondents.

The researcher prepared 10 questions based on **four** objectives. It was created in Goggle form and shared with respondents. most questions were close ended (yes/no, agree/disagree and multiple- choice questions).out of 10 questions ,9 were close ended and one was open ended to allow free responses.

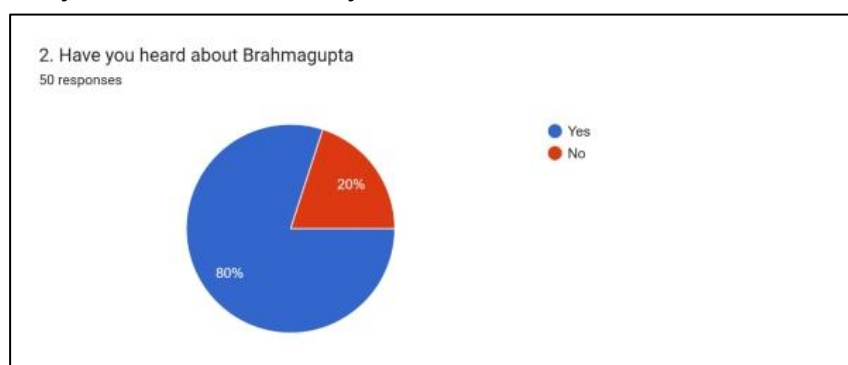
Data Analysis Technique:

For this study, the percentage method was used for data analysis. It is a simple way to present data and understand responses clearly. The questions responses were analysed and converted into percentage, and the data is presented question wise for easy understanding.



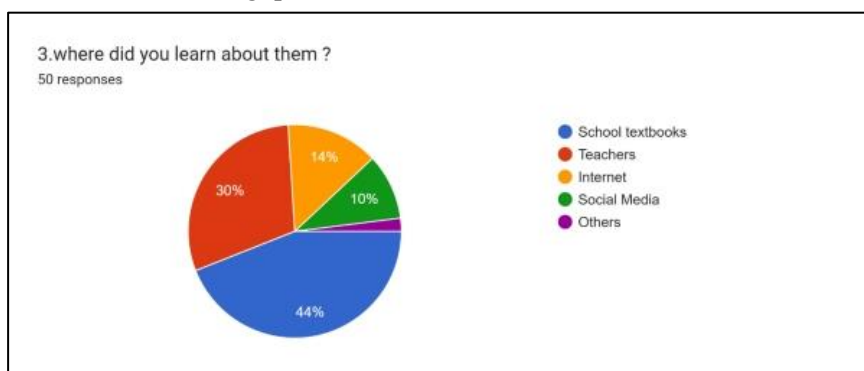
- Yes – 100%

Here, it is seen everyone has heard about Aryabhata.



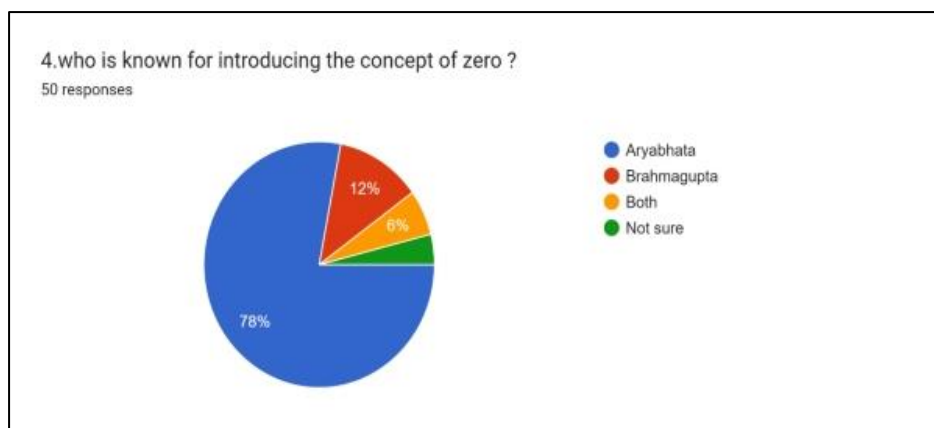
- Yes – 80%
- No – 20%

80% of students has heard Brahmagupta's name whereas rest 20% hasn't.



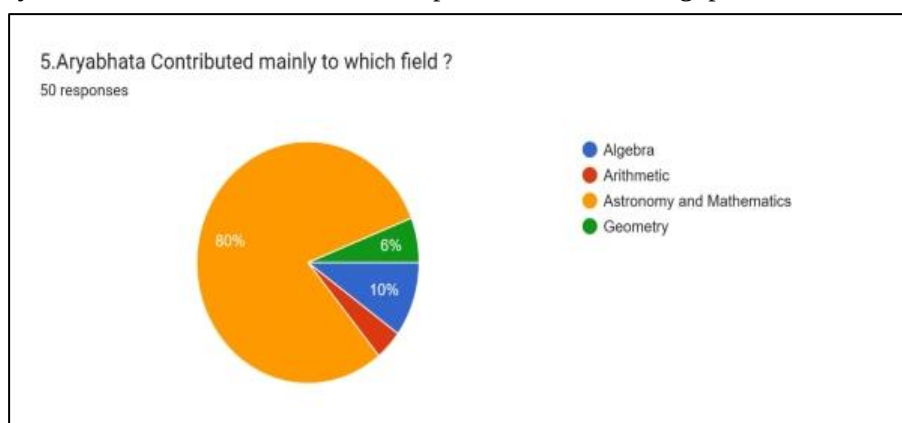
- School textbooks – 40%
- Teachers – 30%
- Internet -14%
- Social media – 10%
- Others – 2%

Here, it is seen 40% of students has learned about them through textbooks ,30% through teachers ,14% has learned about them through internet, through social media 10% last 2% knows about them through anonymous source.



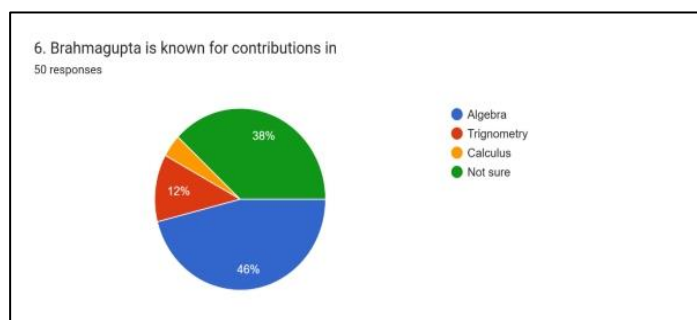
- Aryabhata – 78%
- Brahmagupta – 12%
- Both – 6%
- Not sure -4%

78% said Aryabhata who introduced zero concept, 12% said Brahmagupta while 6% said both.



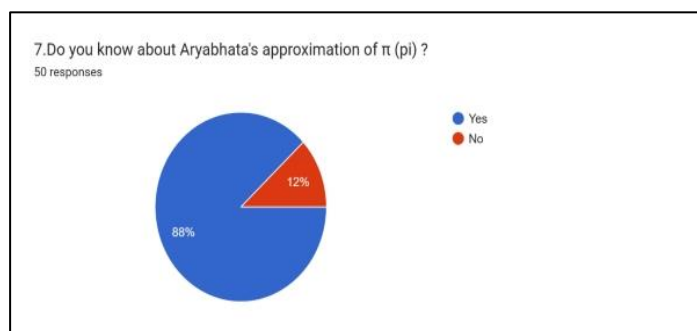
- Algebra – 10%
- Arithmetic – 4%
- Astronomy and mathematic – 80%
- Geometry – 6%

10% said Aryabhata contributed to algebra,4% chose arithmetic ,80% said astronomy and Mathematics while rest 6% said geometry.



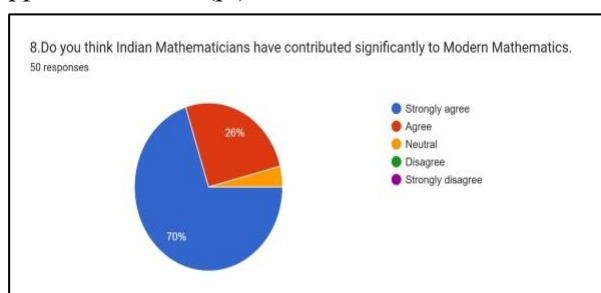
- Algebra – 46%
- Trigonometry – 12%
- Calculus – 4%
- Not sure – 38%

46% students know Brahmagupta's contribution in algebra, 12% know him for trigonometry, 4% for calculus, and 38% are not sure.



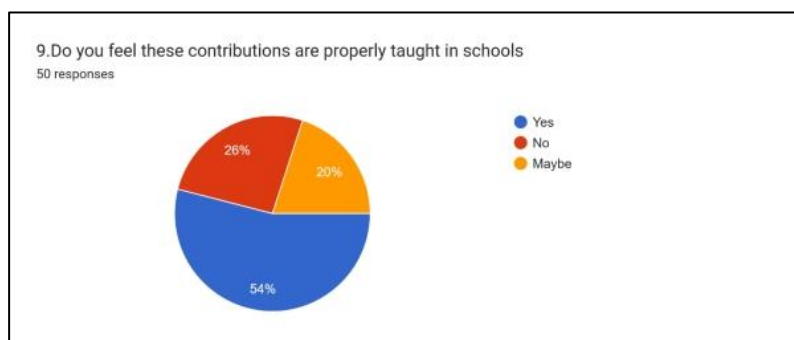
- Yes – 88%
- No – 12%

88% know Aryabhata's approximation of π and 12% don't know.



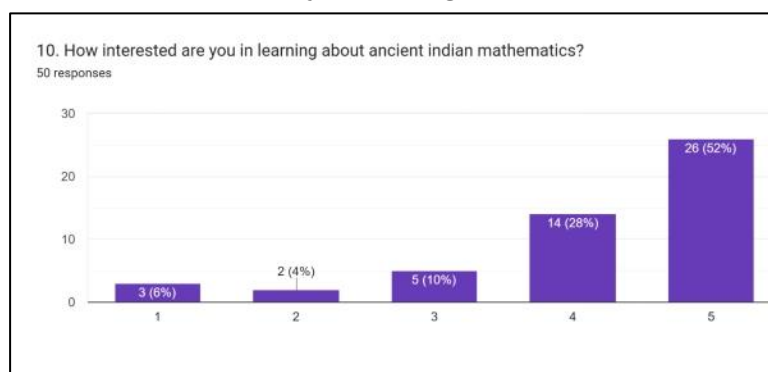
- Strongly agree – 70%
- Agree – 26%
- Neutral – 4%

70% of students strongly agree that Indian Mathematics have contributed significantly to modern mathematics, 26% just agree, and 4% think neutral about this.



- Yes – 54%
- No – 26%
- Maybe – 20%

54% feels these mathematician contribution are properly taught in schools ,26% student's don't feel it is properly taught in schools and 20% feel maybe it is taught in school .



- Extremely Interested – 52%
- Very interested – 28%
- Interested – 14%
- Moderately interested – 5%
- Not interested – 3%
- Slightly interested – 2%

52% are extremely interested in learning ancient Indian mathematics 28% are very interested ,14% are interested, 5% are moderately interested, 3% are not interested and 2% are slightly interested.

Findings of the Study:

The analysis of the data collected from 50 maths students reveals the following key findings:

1. All the 50 students have heard about Aryabhata.
2. A large number of 80% students have heard about Brahmagupta and 20% haven't.
3. Less than 50% has learned about Aryabhata and Brahmagupta from school textbooks, some has heard it from teachers, internet, social media and others.

4. The survey says 78% students are aware of concept of zero was introduced by Aryabhata, remaining 12% chose Brahmagupta and other 6 % said both introduced the concept of zero.
5. A large number of students are aware of Aryabhata contributed to which respective field. Algebra, arithmetic and geometry were also option's chosen in least numbers.
6. Less than half of students were aware of Brahmagupta's contribution which is in algebra and others also chose trigonometry, calculus and some of them were not sure.
7. A large number of students knows aryabhata's approximation of (π), whereas least don't know.
8. Most of students feels Indian mathematician has contributed in modern mathematics, a small group of student's font feel the same and others feel neutral about this.
9. Slightly more than half the students feel these mathematicians contribution has been properly taught in school, a small group of students don't feel the same.
10. More than half of students are extremely interested in learning ancient Indian mathematics, then there are very interested then followed by interested and some strongly disagree and some slightly feel for learning ancient Indian Mathematics.

Conclusion: The study concludes that awareness of Indian mathematics exists at a superficial level but lacks conceptual depth. To address this gap, educational frameworks should incorporate Indian mathematical heritage in a structured and meaningful way.

Survey-based research proves to be an effective method for assessing awareness and can be further expanded with larger and more diverse samples.

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