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Perception of Undergraduate Students towards Use of Digital Technology in Mathematics Education

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ABSTRACT- Digital Technology has been a boon, especially in the field of education. Being one of the mot efficient ways of supplementing the traditional teaching-learning process, it has rightfully become one of the most important facets in the classroom and its application has risen in both quantity and quality. Mathematics as a subject finds constant usage of Digital tools in its pedagogy as well as its application. This study attempts to find the prevalence of Digital tool usage in the mathematics classrooms of the Undergraduate levels. Using a survey questionnaire, the investigators collected data regarding the various aspects of Digital tool integration in a mathematics classroom, reaching the conclusion that despite students perceiving the use and integration of digital technology in their mathematics classroom as net beneficial to themselves, there is not much scope for its development within the classrooms.

KEYWORDS- Digital, Technology, Mathematics, Classroom, Data Exploration, Digital Tools

I. INTRODUCTION

Where required, actions with distinct mathematical goals and objectives are specified and arranged for the most efficient use of ICT. Many programs only suggest possible activities, and how often and to what extent they are used with various groups largely depends on the teacher's interest and inclination. All too frequently, the use of ICT by students is not tracked to determine how it affects standards. Therefore, it should come as no surprise that institutions are rarely able to identify the ICT resources and instructional practices that were most effective. The actual usage of ICT in Mathematics classrooms often gets overshadowed by the availability of computers and other apparels in Higher education leaving behind, the greater aspect of training and knowledge required to operate and integrate such tools, thus on paper - all institutions are ICT equipped but the students often don't know how to make use of the facilities and thus the actual ICT integration remains far and few in between [1].

II. INTEGRATION OF DIGITAL TECHNOLOGY

It is quite feasible to integrate ICT into math classes without having to rethink your own methods of instruction. But because of the medium's immense potency, limiting its usage in this way would deny kids access to a tool that has the potential to completely transform the way they learn. In 1995, the DfES mathematics curriculum IT support group created the pamphlet "Mathematics and IT - a pupil's entitlement" in response to this problem.
It outlines the following six main ways that ICT can help children learn mathematics

A. Acquiring Knowledge From Criticism

The computer frequently offers quick, dependable, objective, and judgment-free feedback. This may inspire students to formulate their own theories, test them, and make modifications.

B. Identifying Patterns

When investigating mathematical problems, students can generate a large number of instances thanks to the speed of computers and calculators. Their observation of patterns and their creation and defense of generalizations are supported by this.

C. Seeing Connections Formulas

Numerical tables, and graphs can all be easily linked thanks to computers. Students learn links between representations when they alter one and observe changes in the others.

D. Using Dynamic Images

Students can work with dynamic diagrams by using computers. As they create their own mental images, this helps them to visualize the geometry.

E. Data Exploration

Students can deal with real data that can be displayed in a variety of ways thanks to computers. This lends credence to interpretation and analysis.

F. Teaching the Computer

Occurs when pupils create an algorithm, which is a collection of instructions, they have to provide orders clearly and in the right sequence; as they hone their concepts, they clarify what they are thinking.

It is well known that adapting the mathematics curriculum to new technical developments, like the introduction of electronic calculators, can take a very long time. However, the usage of pencil and paper methods is becoming less common as ICT has been so widely accepted in many areas of business, research, and industry as a tool for mathematical and statistical modeling and problem-solving. Even while the effects can take time, we should at least be ready to reevaluate our own conceptions of the curriculum's essential components.

III. FEATUES OF A GOOD MATHEMATICS CLASSROOM

A good mathematics classroom should have the following features: well-lit, comfortable computer rooms with enough space for students to work away from computers and for teachers to circulate and speak with individual students; effective communication with the entire class using digital projectors or the ability to control all the computers; computers that are networked and well-maintained; individual workstations, clusters of machines, and computer rooms available to meet departmental needs; and an efficient and equitable computer room booking system. With the usage of wireless connections between banks of computers that are maintained centrally and connected to the school network, institutions are looking into the possibility of offering more flexibility in meeting topic needs. The extent to which institutions are utilizing ICT to improve math instruction varies in an unacceptable way. The best practice is fantastic, but there isn't enough dissemination of it. When creating lesson plans and conducting data analysis outside of the classroom, the majority of math teachers use ICT efficiently. Some still lack confidence in their ability to use ICT and need additional instruction. There are now a ton more excellent teaching strategies available from various sources. To avoid wasting instructors' time looking for relevant materials, there must be greater coordination and distribution of materials, ideas, and resources. Similar to this, there is a wide variety of software available to assist with math instruction, however certain institutions require additional assistance in identifying and implementing the software that best suits their requirements. When students are able to model, investigate, and analyze and improve mathematical concepts and arguments, it would lead to better interest and devotion to the subject [2].

IV. EFFECTS OF DIGITAL TECHNOLOGY

The mathematics curriculum no longer covers several concepts, like complex numbers and matrices. This is paradoxical because, for instance, the majority of graphical calculators can execute common mathematical functions like complex multiplication and matrix inversion[3]. With the help of these resources, we may now focus on developing a deeper comprehension of matrices and complex numbers and their applications without having to carry out tedious and confusing manipulations. It would be beneficial if we could utilize ICT to assist students in understanding the significance of complex numbers and matrices, as these are widely used in 16 ICT, Mathematics, Engineering, Science, and other numerate disciplines. Providing enrichment activities with ICT to facilitate differentiation Three concepts are closely related to enrichment; they do not necessarily contradict one another, but they do represent distinct goals. Acceleration: places students in subjects typically studied by older students, frequently leading to early admission to public exams. Students may be moved into year groups above in all courses or simply the topic in which they perform exceptionally well in order to accomplish this. As an alternative, kids can work more quickly in their own class while remaining autonomous, frequently with some extra assistance. Extension pertains to extending the scope of the curriculum by examining areas of mathematics that are typically not included in the standard curriculum. Opportunities for problem solving that call for students to apply their mathematical knowledge can be found in mathematics. Enrichment aims to broaden students' comprehension of mathematical concepts by utilizing them in various contexts and issues. This frequently necessitates choosing which topic or areas of mathematics to focus on. The objective is to enhance advanced problem-solving and communication abilities. It broadens the definition of applying and utilizing. Producing a critical mathematician who can see beyond the typical "test" type problems is the goal. Enrichment also refers to a method of instruction that promotes communication and discussion in mathematics. It might be challenging to encourage and challenge more capable students in a classroom full of thirty or more students who all require individualized attention. The computer is among the most effective tools at your disposal.In the same way that ICT can support basic literacy or numeracy skills through targeted, skills-focused software or the use of generic software (such as word processors and spreadsheets) or access to resources via the Internet, it can also support the needs of more able mathematicians. More able students will not gain more from computers than other students. When you utilize ICT effectively, you can: locate relevant online resources that can be used offline or converted to a paper-based resource; the resources on the NRICH website, which provides math enrichment tools to students of all ages, are one example of this. Use open-ended assignments and general software to keep students interested. Spreadsheets, dynamic geometry software, and logo all have this potential, but they are skill-based and closed programs that don't provide for the flexibility to promote enrichment. This can be accomplished by: Organizing group projects that will challenge the most capable students while involving all students (differentiation by outcome). Thus, for instance, the entire group may be used to navigate a maze, practicing left and right navigation and distance estimation. In the same room, more gifted students might be building their own maze at the same time [4].

V. EVALUATION IN DIGITAL TECHNOLOGY

There are managerial concerns that must be resolved for the mathematics classroom to become a community of inquiry. To guarantee that every student has an equal chance to practice mathematics using ICT, they include offering materials and continuing professional development to instructors. A defined development strategy to reach national targets for the percentage of ICT-enhanced teaching could be part of this at the senior level. In order to make educated decisions about the relative merits of various ICT services, such as computers with interactive white

boards versus handheld technologies, it also entails making sure the knowledge base is kept current[5]. At every level of mathematics, there are management concerns with the growth of ICT. Interim managers' appraisals can be used to both identify needs and connect them to training needs in a helpful manner. When it comes to helping teachers grow and making sure kids have a positive ICT experience in mathematics, middle managers play a critical role. Teachers' professional development in the use of ICT may be tracked, needs can be identified, and support can be given through appraisal. Ideally, the departmental and overall school development. Teachers react favorably to these parts of the target-setting and appraisal process, in our experience. Evaluation can take place on a variety of levels, such as the use of ICT in a class or the lesson itself, or it can focus on your personal or the department's ICT infrastructure. It will also be necessary for you to assess specific ICT tools in terms of their applicability to the teaching of mathematics. First, let's talk about how you might assess an ICT-based course. To establish the background, we must know: What are you attempting to accomplish? How do you intend to accomplish this? Who will you collaborate with? Then, we'll need to ask pertinent questions, like: Did you achieve the learning goals? Did all pupils' talents receive equal attention and were they actively engaged? Did the pupils have confidence? Was the plenary effective in applying the knowledge to different situations? What kind of math was applied there? How far along were they? Is there room for expansion?

VI. FINDINGS

The findings are explained below using the number of responses and the percentages of responses to each questions in two parameters - Negative or Positive. Figure 1 is a bar diagram on the responses recorded to the questions asked to the students.

A) Number of Responses

a) 48 responded Yes and 2 responded No to Question 1.
b) 20 responded Yes and 30 responded No to question 2.
c) 9 responded Yes and 41 responded No to Question 3.
d) 22 responded Yes and 28 responded No to Question 4.
e) 38 responded Yes and 12 responded No to Question 5.
f) 30 responded Yes and 20 responded No to Question 6.
g) 17 responded Yes and 33 responded No to Question 7.
h) 29 responded Yes and 21 responded No to Question 8.
i) 27 responded Yes and 23 responded No to Question 9.
j) 30 responded Yes and 20 responded No to Question 10.
k) 15 responded Yes and 35 responded No to Question 11.
l) 13 responded Yes and 37 responded No to Question 12.
m) 16 responded Yes and 34 responded No to Question 13.
n) 40 responded Yes and 10 responded No to Question 14.
o) 40 responded Yes and 10 responded No to Question 15.

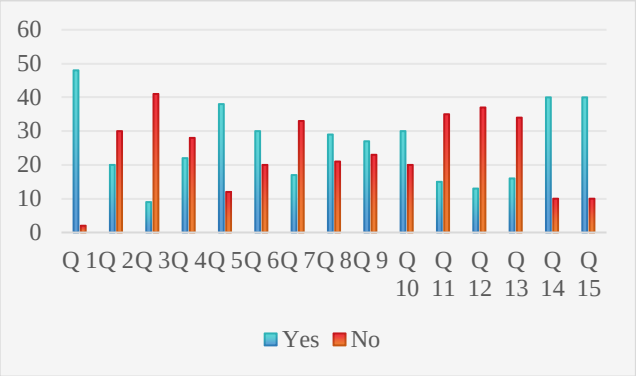

Figure 1: Responses to questions

B) Percentages of Responses

a) 96% responded positively to using digital tools during their studies.
b) 60% responded negatively to having access to digital tools in their mathematics classroom.
c) 82% responded negatively to using digital tools for teaching-learning activities in their mathematics classroom.
d) 56% responded negatively to getting encouragement from their teachers in including technology with their mathematics learning.
e) 76% responded positively to getting scope for the development of their mathematical knowledge through use of digital technology.
f) 60% responded positively towards being able to use computer programmes to solve complex mathematical problems.
g) 66% responded negatively to making use of computer software to solve Linear Equations.
h) 58% responded that they thought, using computer applications helped them solve problems integral calculus better.
i) 54% responded positively to using calculators to solve statistical problems.
j) 60% responded positively towards having smart classroom facilities in their mathematics classroom.
k) 70% responded that there was no use of digital tools in their mathematics classroom on the part of the teacher.
l) 74% responded negatively to digital tools being used in their classrooms for the purpose of assessment.
m) 68% responded that their teachers did not encourage them to submit assignments online.
n) 80% responded that the use of digital tools is helping them become more proficient in Mathematics.
o) 80% responded that the use of digital technology in Mathematics helps them focus better on the more complex topics.

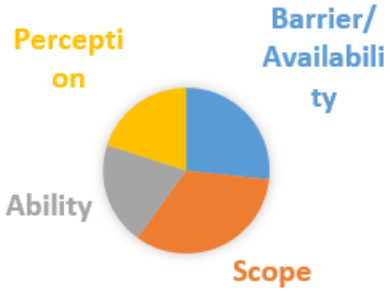

Figure 2: Types of Questions

The Pie Chart Figure 2 shows the various groups of questions that were included in the questionnaire given to the students. Questions bearing similar characteristics were placed together in the questionnaire and the questionnaire in itself consists of four broad types of questions - **Barrier**(access to digital technology in the mathematics classroom), **Scope**(encouragement and opportunity to use digital technology in the mathematics classroom), **Ability**(the ability and skills of the students in using various digital tools for mathematics learning and **Perception**(what the students think about the role of digital tools and technology in their mathematics classroom.

VII. INFERENCE

A common perception among students is that the use of Digital Tools in the study of mathematics is helping them become more proficient in the field of mathematics and devote more time to actual theoretical problems rather than spending the majority of their time on calculations. Furthermore, almost all students agreed on using digital tools during their self study but a majority find it difficult to solve the more complex calculations using digital tools. This shows that though students use the tools for study, they either lack information or training on using specific applications to solve the more complex problems such as Linear equations, Calculus and Statistics. Analyzing responses, leads to another revelation that teachers and institutions themselves often do not encourage the use of Digital tools in their Mathematics classrooms. The lack of usage extends not only to Teaching, but also to assessment and assignments, all of which the teachers still prefer to do in the traditional way.

VIII. CONCLUSION

The findings of the paper denote that students perceive digital tools and technology as a positive driving force in their mathematics classroom and in the process of their mathematics learning. Furthermore, the findings also show the disparity in the positive perception of the students towards the use of digital tools and the lack of their availability in the classrooms where the process of mathematics teaching-learning goes on. The study also shows that students do not know how to access mathematical applications and programmes they otherwise could to make their mathematics learning experience, more enriched.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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ANNEXURE - I

1) Do you use digital tools such as smartphones and laptops at home during your studies? YES/NO
2) Do you get access to Digital Tools in your mathematics classroom? YES/NO
3) Do you make frequent use of Digital Tools for teaching-learning activities in your mathematics classroom? YES/NO
4) Do you get encouragement from your teachers to include Digital software in your mathematics teaching? YES/NO
5) Do you get scope for the development of your Mathematical Knowledge through use of Digital Tools? YES/NO
6) Are you able to use computer programs for complex Mathematical Calculations? YES/NO
7) Have you made use of computer software to solve Linear Equations? YES/NO
8) Do you think using computer applications helps you to solve problems of Integral Calculus better? YES/NO
9) Have you used calculators to solve statistical questions? YES/NO
10) Do you have a smart classroom facilities for your mathematics classroom? YES/NO
11) Do you see the use of Microphones, Speakers and Projectors during the teaching-learning processes in your mathematics classroom? YES/NO
12) Are Digital assessment tools such as online tests and quizzes used in your mathematics classroom? YES/NO
13) Do your teachers encourage you to submit assignments online? YES/NO
14) Do you think that the use of Digital Tools is helping you become more proficient in Mathematics? YES/NO
15) Is the use of Digital tools in Mathematics helping you focus better on the more complex topics? YES/NO

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