The Impact of the Use of Microsoft Mathematics Calculus Visualization on Student's Attitude

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ABSTRACT

The application of mathematical concepts to real-world problems causes students to have difficulty with the concepts. On undergraduate students, a quasi-experimental research study and visualisation of calculus concepts were conducted as part of a larger project. They were discovered to have a preference for mathematics. As a result, students gained a better understanding of concepts and a more positive attitude. In our class, we had two groups of students who were both from the computer science department and who had both taken the same calculus course. Each group, consisting of fifteen students, was divided into two groups: the control group and the experimental group. Using a traditional learning method, the students in the control group were taught topics such as differentiation and integration, among others. The experiment group, on the other hand, had taught the same lesson using a Microsoft Mathematics visualisation tool, instead. The findings revealed that using Microsoft Mathematics visualisation, the students gained a more significant, positive, broader, and conceptual understanding of calculus than they would have otherwise. In addition, the quasi-experimental study found that there was a statistically significant difference in students' attitudes between the pre-test and the post-test. With the help of Microsoft Mathematics visualisation, students were more fascinated and attracted towards calculus concepts than before.

Keywords: *Attitude, Calculus concepts, Calculus mathematics, Conceptual understanding, Student conceptual understanding, Visualization.*

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Highlights of this paper

- It delivers a Microsoft Mathematics influence element on students' perceptions.
- It compares the experimental and traditional methods.
- It displays the calculus effectiveness level for each student's class level independently.

1. INTRODUCTION

Mathematics is a significant subject area. Mathematics is directly or indirectly involved in all professions and sectors of life, whether directly or indirectly. Students have difficulty understanding and solving mathematical problems at all levels of education, including high school, college, and graduate school. When confronted with mathematics during their undergraduate studies, students demonstrate poor conceptual understanding as well as a frightful attitude. When teachers deliver a mathematical lecture using traditional methods, students have difficulty understanding the concepts being taught (Arango, Gaviria, & Valencia, 2015a).

The visualisation and depiction of mathematical expressions and practices are critical in the delivery of mathematical lessons and the learning of mathematical concepts. Visualization software is frequently used to educate and understand various mathematical ideas since it is a method and a highly structured instrument that is highly organized. There are visualisation and interactive features in the software that aid in the representation of information as well as in cognitive, computation, research, and problem solving. Because this computer application technology is becoming more visible and significant for students, they are being encouraged to use it into their classroom mathematical training. When implemented in a school setting, this can assist students in developing their conceptual abilities as well as their attitudes (Arango, Gaviria, & Valencia, 2015b).

Single-oriented education is the most often used teaching technique nowadays. The instructor is at the core of the classroom atmosphere, which encourages approach and completion but offers little time for students to contemplate. Students are passive participants in classroom learning, and teachers cannot adapt to each pupil's different requirements and desires. Students are enthusiastic listeners who regard the instructor at the focus of their attention. Although the educational system is poor, resources are scant, and education is passive, the information is well-formed and removed from reality. Direct experience is an imperfect or nonexistent subjective experience, which restricts the efficiency of learning processes (Nawzad, Rahim, & Said, 2018).

Nowadays, the learning environment has been shifted from conventional method to technology-based learning. Modern instructional instructions and tactics are getting more beautiful, lively, enjoyable, engaging, and utilizing new digital applications. When incorporating software applications into the classroom setting, teachers make their learning materials and daily lesson plan more innovative, clear, dynamic and student-oriented (Raja, 2018).

The results revealed that the experimental group performed exceptionally well. It also proved that the control group did not do any better. When students were introduced to Microsoft Mathematics instead of using traditional learning environment, they had a superior conceptual comprehension. Students gained a better understanding of concepts as well as a positive attitude toward using the most recent software tools (Sahin, Cavlazoglu, & Zeytuncu, 2015).

After a comprehensive, result oriented, well tested, repeatedly preforming experiments, we deduced from the conclusions that experimental group students were found more interested, inclined, fascinated, attractive, dedicated and innovative toward Microsoft Mathematics visualization as compared with control group. It showed us that the innovative technologies applications like Microsoft mathematics (MM) have great role in learning and teaching processes (Septian, Suwarman, Monariska, & Sugiarni, 2020).

The rest of the paper is structured in the following manner; "Background and Related Work" briefly discusses the background and related work. "Materials and Methods" briefly discusses the methodology of the work. "Results and Discussion" evaluates the results and discussion. Lastly, we conclude and recommend "future work" (Tamur, Juandi, & Kusumah, 2020).

2. BACKGROUND AND RELATED WORK

The 21st Century has various technological innovations and variations daily, so the teaching method is also changed dynamically. Software applications-based instruction has enabled learning and teaching; more attractive, engaging, entertaining and enjoyable. The software applications are integrated into the curriculum; teachers begin to make a creative daily lesson plan, assignments and students learning resources. Digital disruption presents a barrier to learning in the digital age. Generation Z was raised in a technologically advanced world. For digital learning, the usage of diverse digital devices in instructional design is a high priority. Using digital learning media is the best technique to implement a digital learning process. An important part of the digital learning process is the use of digital learning media as a conduit for knowledge. Since it's adaptable and simple to incorporate (Putra et al., 2021; Siddiqui, 2021).

New technology has the ability to significantly improve educational and personal growth. The latest instructional tools have a greater impact on students' conceptual, individual, and academic development, as well as encouraging learning processes. Technology-based learning was investigated in Europe, and the results revealed that it had relatively little influence on students (Muñante-toledo et al., 2021; Okere, Su, Gu, Han, & Tan, 2021).

Digital Technology includes digital laptops, computers, calculators, mobile computers, communications devices, and visual equipment and software. Dick pointed out that technology plays two key roles in classrooms: communication and engagement. The previous study focused on technology methods for sharing and transmitting information between teachers and students. By analyzing the content to be transmitted and presented, as well as the potential for collaborative solutions, Transmission technologies help teachers in thinking, understanding, and production. Lecture tools like as interactive boards, Microsoft PowerPoint, the internet, and collaboration programmes (computer-generated classes in which participants can collaborate), as well as measuring, monitoring, and delivery systems, are among these technologies (formative assessment, personal screen application) (Irvine, 2020; Ramdani, Mohamed, & Syam, 2021). The other relates to technological techniques that enable students to do mathematical activities or respond to user behaviors in mathematical ideas in a standardized manner. New technologies systematize the clear and practical application of mathematics in real-world situations, solve real-world issues, and reproduce classroom exercises and procedures. Computational toolkits, dynamic geometrical software, computer manipulation, and computer models are examples of these methods (such as calculators and simulation applications) (Oktaviyanthi & Supriani, 2015).

Technology is recognized as a tool and a crucial element to support visualization and interactive media that aid in problem-solving when it comes to mathemctics education. Technology is vital in teaching and studying mathematics, according to National Council of Teachers of Mathematics (NCTM). Attitudes of teachers influence the use of technology in mathematical education. Using technology in school enhances learning compared to traditional methods. Technology helps students connect schools and the world by providing dynamically linked multimodal representation, interactive models and simulations of learning material. Using technology in the classroom should help students grasp complex concepts and solve problems. Many research has focused on various aspects of integrating technology into education. Chung, Marvin, and Churchill (2005) states that "technology enhances our intellectual and physical capacity", and in this sense, technology supports complicated learning. Using a computer to present and transmit learning materials is one way to integrate technology into education. Multimedia instruction uses words and images to facilitate teach. Thus, information is digested verbally and nonverbally, allowing students to maximize their cognitive ability to understand it. It is related to "dual coding theory," which stresses the concretization of knowledge through images and visuals. The idea of multimedia training is crucial. Students learn more effectively from words and visuals than from just words, claims (Mayer & Oancea, 2021). It enables learners to create links between their verbal and visual mental models. Limits, derivatives, integration, and infinite series are all part of calculus. Calculus is used to address difficult issues that cannot be solved by fundamental algebra approaches. Based on the author's experience lecturing first-year students at Universities Serang Raya's Faculty of Information Technology, most students' deficiencies are simple computations. This dilemma requires teachers to discover creative solutions. Calculus is designed to help students acquire skills in comprehending, reasoning, and problem solving. The computer is utilized to solve these problems. Several computer programmes can be used to teach interactively. Microsoft Mathematics is a freeware tool from Microsoft that uses a symbolic computing architecture and works with mathematical expressions (Del Cerro Velázquez & Méndez, 2021; Mendezabal & Tindowen, 2018). Microsoft Mathematics is suitable for students to answer problems in Linear Algebra, Statistics, Calculus, and Trigonometry. Mathematical knowledge is one of the fundamental goals of mathematics education. Mathematics is one of the most difficult and demanding disciplines in education. Mathematical knowledge is widely employed in everyday life and applied to many other branches of science, making it the most important topic in science. Mathematics is a fundamental instrument in analyzing every area of human life. As a result, teachers must focus on developing students' mathematical concepts and provide a quality teaching environment. Mathematical ideas are difficult for many students. According to Duval, "there is no mathematics without visualization". The image is meant to help pupils understand mathematical ideas. Students may use technology to comprehend ideas, reason, learn, solve problems, and produce new information. Additionally, it aids pupils in visualising mathematical ideas. Previous research has demonstrated that arithmetic learning may be improved by visualisation exercises (Mayasari et al., 2021; Palancı & Turan, 2021). Pietri, Ashburn-Nardo, and Mukhopadhyay (2021) emphasised the need of using technology in mathematics education to assist students in making graphical reprensentation and symbolic expressions of mathematics. Technology-based actions, perceptions, and learning goods involve doing, teaching, and perceiving. Students can communicate information, involve multiple models of presentation, and recall how a material can be presented using multimedia. Students can use multimedia to represent an abstract mathematical object. Using representational tools in teaching and learning can help students acquire mathematical comprehension. This skill allows pupils to connect and re-present objects in new ways, demonstrating their knowledge and understanding. Many academics have determined that interactive technology, particularly visualization tools, may effectively engage students in meaningful learning (Beynon, Munday, & Roche, 2021). An interactive visualization enhances the learning process. Connecting various visualizations also improves cognitive growth. So that pupils can better grasp, educational technology should be animated and flexible. It is said by Hadjerrouit (2019) that "students must see things moving to comprehend". Calculus is a math subject. Calculus is covered in almost all subjects, including engineering, physics, business, economics, computer science, and information systems. Calculus concepts are given in a systematic, logical, and hierarchical way. In other words, knowledge of one notion is necessary to perceive another. As a result, studying Calculus is essential for learning. However, many students find Calculus difficult to grasp. Calculus is a mathematical subject with an abstract concept that most pupils cannot visualize. Microsoft Mathematics is free software. This software allows users to compute mathematics. Simple instructions can be used to write, calculate, and manipulate mathematical expressions, as well as 2D, 3D, and animation graphics. Microsoft Mathematics provided the same step-by-step result as when done manually. For example, the first derivative of f(x) and its graph in 2D and 3D will be explored.

This study sought to solve the following research questions: 1. How can Microsoft Mathematics help teach, learn, and understand Calculus? 2. How does using Microsoft Mathematics affect students' views towards arithmetic in the classroom? This study's initial goal is to describe how students utilize Microsoft Mathematics to build mathematical knowledge and understanding. This data was acquired from both the experimental and control groups' pre- and post-tests. The data were then compared quantitatively between the experimental and conventional groups. To answer the second research question, we used quantitative and qualitative data from a survey about students' attitudes toward Microsoft Mathematics. This study used a mixed method approach that combined quantitative and qualitative research approaches. The quantitative approach helped assess students' grasp of Calculus principles using Microsoft Mathematics.

The Table 1 presents Microsoft Mathematics (MM) is an open-source software that can download from microsoft website. Microsoft Mathematics (MM) is suitable for helping students in Calculus, Statistics, Linear Algebra, and Trigonometry.

Table 1. Microsoft mathematics (MM) brief details.

Price	**Free**
Developer	Microsoft
License	Free
Operating System	Windows
Size	17.5 MB
Website	www.microsoft.com/download/details.aspx?id=15702
Stable release	4.0.1108.0000/January 11,2011
Topic Covered	Calculus, Statistics, Linear Algebra, Trigonometry

Students can easily visualize various concepts of Calculus with the help of Microsoft Mathematics. Microsoft Mathematics is an open source software, and it is utilized for problem-solving step by step.It is a complete and comprehensive software package which is used to help students with Calculus, Statistics, Linear Algebra and Trigonometry. It also provides the students with a user-friendly interface which displays 2-D and 3-D diagrams and visualization.

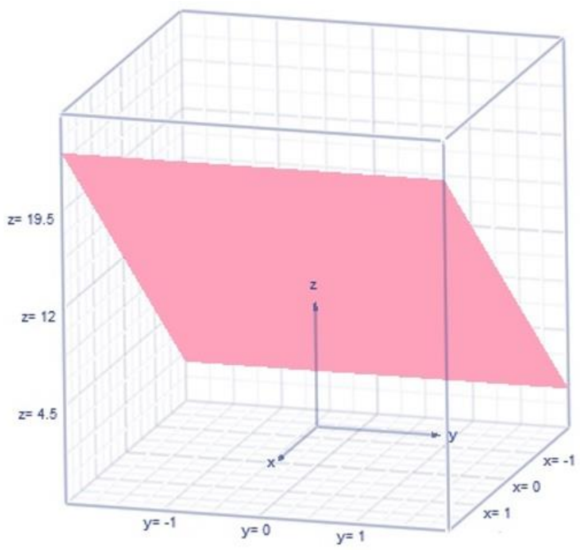

Figure 1. f(x) = deriv(x^3+6x^2-3x+9,x) 3-D diagram in microsoft mathematics.

Differentiation, in calculus mathematics, method of finding the derivate of a function or rate of change of a function f(X). Let we have f(x)= $\frac{d}{dx}(x^3 + 6x^2 - 3x + 9)$ is a function. Using Microsoft Mathematics, we calculated the first and second derivatives of a function and also drew their 2D and 3D representations to demonstrate our understanding. It is an extremely effective tool for problem solving. Figure 1 depicted the second derivates as well as its three-dimensional representation.

The discovery of an integral is the process of integration. It is used to calculate quantities such as area, volume, displacement, and so on. Figure 2 depicts the first integration of f(x) = (x3+6x2-3x+9)dx and the double integration of f(x) = (x3+6x2-3x+9)dx. The 3D graph depicts the first integration of f(x) = (x3+6x2-3x+9)dx.

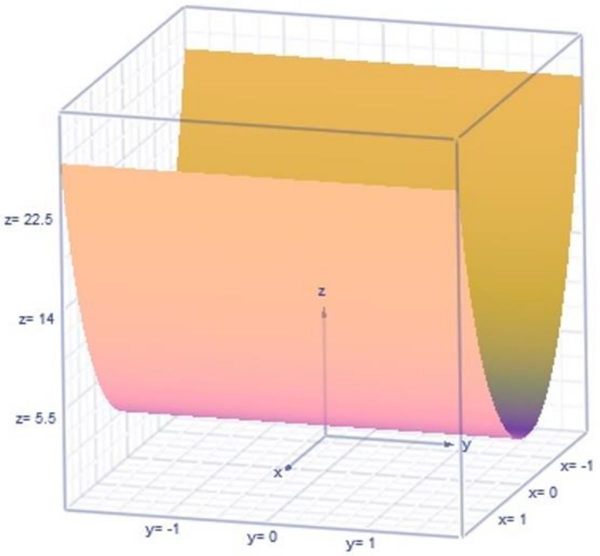

Figure 2. f(x)= $\int\int(x^3 + 6x^2 - 3x + 9)dxdx$, 3D diagram in microsoft mathematics.

In summary, the majority of the study work that is similar to the above is concerned with the use of technology in education. Visualization of mathematical applications, on the other hand, has not been considered in classroom instruction. Furthermore, the majority of the existing study has been conducted using the traditional method. Nonetheless, it did not take into account whether or not visualisation of mathematical applications is included in classroom education, which was the purpose for our research project.

3. MATERIALS AND METHODS

The study performed the below-mentioned research questions:

1. What is the impact of Microsoft Mathematics visualization on students' conceptual understanding?
2. What is the impact of the attitudes of students towards Microsoft Mathematics?

The purpose of this study is to determine how the use of Microsoft technology affects students' understanding of mathematics subjects. The information was gathered from the pre-test of calculus topics in order to analyse the results. In a similar vein, information is acquired from the post-test in order to verify their results. The data was evaluated and analysed quantitatively, with the group in the Microsoft Maths and Statistics teaching group scoring higher than the rest of the participants. We conducted a quantitative analysis using data from a poll of students' opinions toward completing the second research problem by Microsoft Mathematics, which was conducted earlier this year.

In this research study, we used a hybrid strategy that included both quantitative and qualitative evaluation components. In our research, we discovered that having students use Microsoft Mathematics to compute class content expansion improved their grasp of and ability to acquire Calculus ideas. The participants in this study totaled 30 people. The pupils were divided into two groups based on a random draw: the control group and the experiment group. The experimental group learned about calculus principles through the use of Microsoft mathematics visualisation, whereas the control group was taught using a more traditional teaching style. It was administered to the experimental group a questionnaire regarding mathematical confidence and visualisation, which was implemented by Microsoft mathematics and administered using a computer. The questions are about one's level of comfort with computers. This study made use of a well-established questionnaire produced by Fogarty, Cretchley, Harman, Ellerton, and Konki (2001) as well as other researchers. According to the results of the questionnaire, the students' attitudes about mathematics confidence and technology-based learning were determined.

An outline of the theoretical study was produced and demonstrated, which contained numerous calculus concept problems that were completed using the Microsoft Mathematics software. The results of the investigation were recorded and double-checked.

Table 2. The table of events are performed using microsoft mathematics.

The aim of applying the Instrument		A summary	Teaching Method advantages
Encouraging students to practice their principles in real-world situations	An actual problem solution	students with the different approaches to solving a Calculus problem, Microsoft included a wide variety of software tools. Students may be used as a first step in resolving problems for the numerical or algebraic approach to getting things figured out.	Teach things that are simple first, as a result of which can perform more complex tasks faster anyone who participates in the education and learning process benefits from that
	Calculation	students performed calculations with Microsoft Mathematics to determine what the function's values	
Parameters Changes	Visualisation	Students applied Microsoft Mathematics to help them visualise a function, a topic they were learning, or a problem scenario. e.g., Students can alter the parameters of the Calculus equation to see how the graphical changes occur.	To determine variable values input, give rise, the Calculus's expressions will be represented graphically.
	Graphing /Sketching	Students employed Microsoft mathematics to draw functions and investigate various region applications under an exponential curve and its properties and relationships between two functions.	
Conceptual understanding	An exploratory	Direct input helps produce a graphical representation of one or more functions using Microsoft Mathematics or its free version, Microsoft Algebraic. However, it can only be used to design graphs with more than are built using that way.	It is stressed that understanding and learning algorithms that expand/generalise ideas is especially significant.
	Confirmatory	Those students who used Microsoft Mathematics to check their answers in problem-solving exercises.	

In this study, an experimental technique was employed, which entailed establishing the aims, making preparations to achieve the objectives, and collecting and analysing data to determine the results (2008) (Gibbs et al., 2017). The primary focus of this investigation was on two critical aspects of teaching and learning: developing a methodology for using Microsoft Mathematics, group assignments, and analysing some elements to be used during lectures; and developing a methodology for using Microsoft Mathematics, group assignments. In 2008, Wilson published a paper on the topic of formalised formalised formalised formalised formalised formalised formalised formalized (Wilson & Gerber, 2008). These procedures are detailed in the Table 2, along with any testing alterations that may be required.

Microsoft Mathematics supports students in the study of various calculus ideas, as well as the fundamental expressions that underpin such concepts. In Microsoft Mathematics, which is an open software platform, students may demonstrate their work and provide ideas to the instructor, or they could take tests on a wide range of topics during the course of the day.

4. RESULTS AND DISCUSSION

Students' behaviour around Microsoft Mathematics calculus concepts was observed in a classroom setting to determine the influence of conceptual understanding and to assess students' attitudes toward them. We had constructed a quasi-experimental study that consisted of two groups, namely, the control group and the experimental group. Each group consisted of 15 pupils. Actually, we had undertaken a series of quasi-experimental studies in order to compute the means of the results. The mean values for the control group were 72.8 and 74.6 at the beginning and end of the study, respectively.

Table 3. Control group values of the pre-test and post-test details.

Students of the Control group				
S. Num	**Control Group**	**Pre-test**	**Post-test**	**Score difference**
1	First student	62.0	50.0	-12.0
2	Second student	70.0	69.0	-1.00
3	Third student	66.0	73.0	7.00
4	Forth student	72.0	68.0	-4.00
5	Fifth student	68.0	70.0	2.00
6	Sixth student	73.0	75.0	2.00
7	Seventh student	85.0	86.0	1.00
8	Eighth student	74.0	80.0	6.00
9	Ninth student	66.0	75.0	9.00
10	Tenth student	81.0	85.0	4.00
11	Eleventh student	71.0	69.0	-2.00
12	Twelfth student	63.0	70.0	7.00
13	Thirteenth student	89.0	85.0	-4.00
14	Fourteenth student	80.0	84.0	4.00
15	Fifteenth student	72.0	80.0	8.00
Mean		72.8	74.6	1.80

In a similar vein, the pre-test and post-test mean values of the experimental groups were 73.2 and 77.8, respectively. Conclusion It was discovered that the difference in mean values between the control and experimental groups was 1.8 and 4.6, respectively. This explained why the experimental group received more excellent grades when compared to the control group. More importantly, interpreting the statistical data revealed that the p-value of the experimental group was statistically significantly higher than that of the control group, and the distribution of statistical data of pre-test marks was consistent. The results of the pre-test revealed no statistically significant differences between the experimental and control groups. All pupils were held to the same high academic standards, which were uniform and equitable. The control group is instructed in the traditional method, which is crucial for analysing the results of the post-test. A Microsoft Mathematics training course is then provided to the experimental group following that. A strong understanding of the content was demonstrated by the students' mean grades of 72.8 and 73.2 out of 100. The mean values of the two groups (control and experimental) are derived in the following tables, which show the results.

Both tables clearly revealed that both the experimental group and the control group had a total of 15 students in each group. When the pre-test and post-test were carried out, the mean values difference between the control and experimental groups were calculated to be 1.8 and 4.6, respectively, when comparing the control and experimental groups. The mean value difference between the experimental and control groups was 4.6, which is bigger than the difference between the control and experimental groups. The experimental group of pupils outperformed the control group in terms of academic performance. Some students had fared quite poorly in the group's post-test, and this was one of those students. Data for the control and experimental kinds were presented in depth by the Tables 3 and 4, which contained thorough statistical information.

Table 4. Experimental group values the pre-test and post-test details.

Students of the Experimental Group				
S. Num	**Experimental Group**	**Pre-test**	**Post-test**	**Score difference**
1	First student	65.0	80.0	15.0
2	Second student	75.0	79.0	4.00
3	Third student	77.0	78.0	1.00
4	Forth student	70.0	75.0	5.00
5	Fifth student	70.0	75.0	5.00
6	Sixth student	73.0	78.0	5.00
7	Seventh student	90.0	93.0	3.00
8	Eighth student	72.0	74.0	2.00
9	Ninth student	60.0	70.0	10.0
10	Tenth student	75.0	80.0	5.00
11	Eleventh student	74.0	77.0	3.00
12	Twelfth student	65.0	70.0	5.00
13	Thirteenth student	80.0	81.0	1.00
14	Fourteenth student	79.0	82.0	3.00
15	Fifteenth student	73.0	75.0	2.00
Mean		73.2	77.8	4.60

Table 5. The table displayed pre-test in both groups.

Tests of Normality						
	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Experimental_PreTest	0.134	15	0.200*	0.961	15	0.706
Control_PreTest	0.173	15	0.200*	0.942	15	0.411

Note: *. This is a lower bound of the true significance.
a. Lilliefors Significance Correction.

If students count fewer than or equal to 50 values, the data is subjected to the Shapiro test on the population variance, which determines if the data is normal. When the value of p is equal to or greater than 0.05, the data would be expected to follow a normal distribution. As indicated in Table 5, the p-values for both the control and experimental groups are greater than 0.05. It demonstrates that the distribution of statistical data from the pre-tests is normally distributed.

Table 6. The statistical datal description of pre-test scores in both groups.

Statistical Information				
	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
Experimental_PreTest	15.000	73.20	1.844	7.143
Control_PreTest	15.000	72.800	2.038	7.893
Valid N (listwise)	15.000			

The findings of the pre-test did not differ between the experimental and control groups, according to the data in Table 6. The intellectual backgrounds of the students were comparable and equal. This knowledge is critical for analysing post-test outcomes by contrasting the results of the control group, which received teaching using the traditional technique, and the results of the experimental group, which received instruction using the Microsoft Mathematics software. The pupils' mean and median scores were 72.8 and 73.20 points out of 100, respectively.

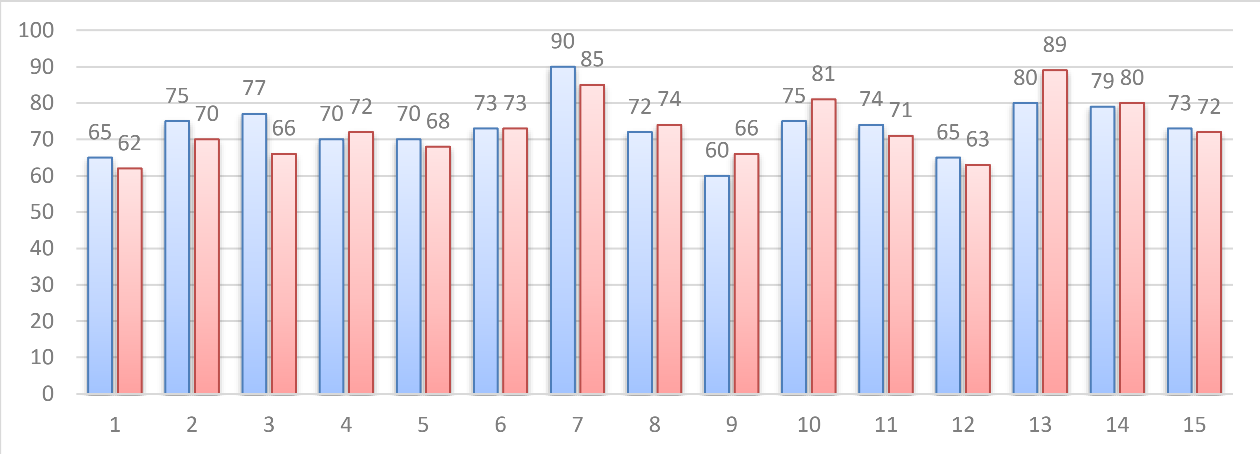

Figure 3. Graphical representation of students of pre-tests in both group.

The Figure 3 implied that the frequency for both groups was similar at a more excellent range, which was supported by the data. The second intervals, 70-85 and 60-69, were different, but 50-59 and less than 50 had no pupils in any period. The experimental group outperformed the control group throughout the second interval, which was 70-85.

Tables 6 and 7 provide the results of the test, including all of the statistical information regarding the scores of both groups.

Table 7. The table displayed the normality test in both post-test groups.

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Experiemtal_PostTest	0.158	15	0.200*	0.890	15	0.067
Control_PostTest	0.176	15	0.200*	0.887	15	0.060

Note: *. This is a lower bound of the true significance.
a. Lilliefors Significance Correction".

Table 7 suggested that the experimental and control group experiments had a substantial difference in the difference between their means, all more than 0.05. Therefore, the distribution was the same for all.

Table 8. The statistical description of both group post-test scores.

Statistical Description				
	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
Experiemtal_PostTest	15.000	77.800	1.432	5.544
Control_PostTest	15.000	74.600	2.439	9.447
Valid N (listwise)	15.000			

In the Table 8, it is inferred that the experimental group values were higher than those of the control group by 3.2 percentage points. It was discovered that the experimental group pupils outperformed their counterparts in the control group. It also shown that the experimental group pupils possessed superior conceptual knowledge compared to the control group students. During class, the kids appeared to be interested in what they were studying.

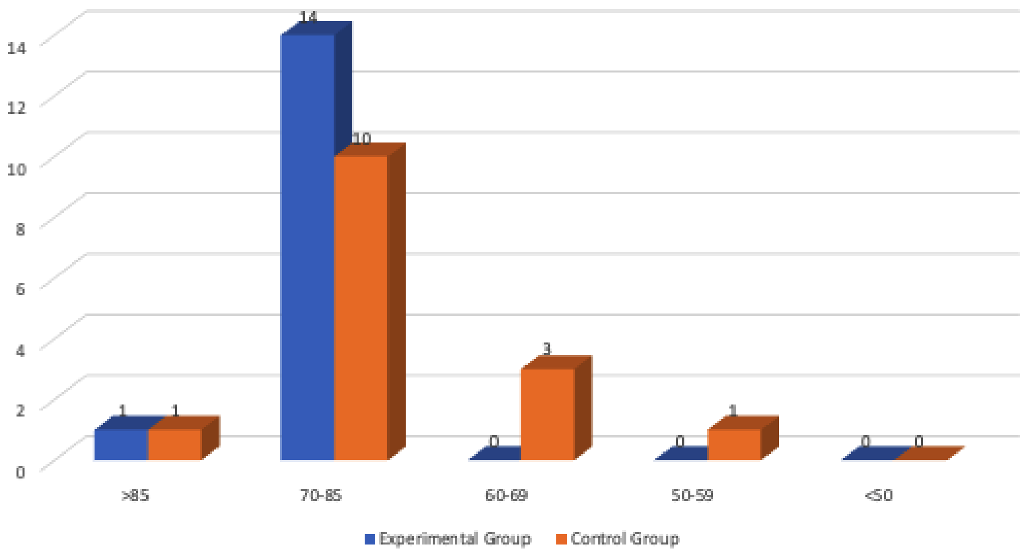

Figure 4. Graphical explanation of students post-test in both group

Figure 4 demonstrated that the experimental group consisted of only one student. The control group only had one student performance score of greater than 85, whereas the experimental group had a larger frequency of scores in the 70-85 range than the control group. Students in the experimental group outperformed those in the control group in terms of test scores.

To assess the attitudes of learners on the visualisation of "Microsoft Mathematics."

The Cronbach alpha, which measures student attitudes regarding Microsoft Mathematics, is presented in the following table. The results of Table 9 demonstrated that the experimental group's pre- and post-test pupils performed much better than the control group.

In addition, questionnaires 1 and 2 were distributed to and received by participants from both groups.. They were concerned with students' confidence in mathematics in the first section of the questionnaire, and they were concerned with students' trust in computers in the second section of the questionnaire. The findings were detailed in the section that follows.

Table 9. Cronbach's Alpha constant value of both group.

Reliability coefficients.		
Method/Technique	**Number of Items(N)**	**Reliability Coefficients (Cronbach's Alpha)**
Experimental	Overall Item 23	0.939
	Confidence of Mathematics 11	0.852
	Confident of Computer 12	0.929
Control	Overall Item 23	0.892
	Confidence of Mathematics 11	0.683
	Confident of Computer 12	0.869

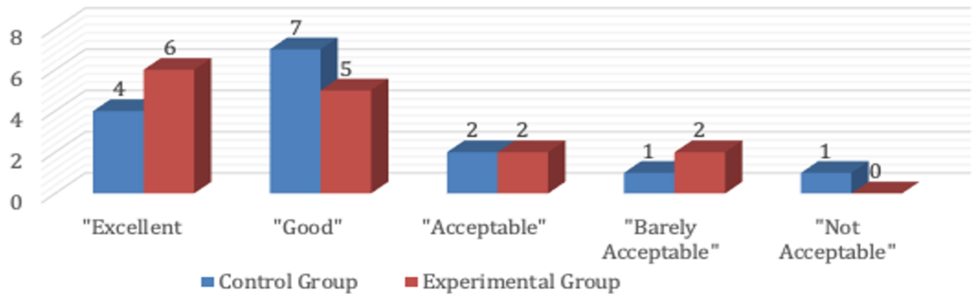

Figure 5. Graphical representation of students attitude toward mathematics confidence in both group.

The Figure 5 proved that many students in the experimental group had an "excellent" attitude toward learning mathematics, while the control group had a "very good" attitude towards mathematics confidence. The questionnaire consisted of 23 questions in which 11 questions were related to mathematics confidence and 12 questions were related to computer confidence.

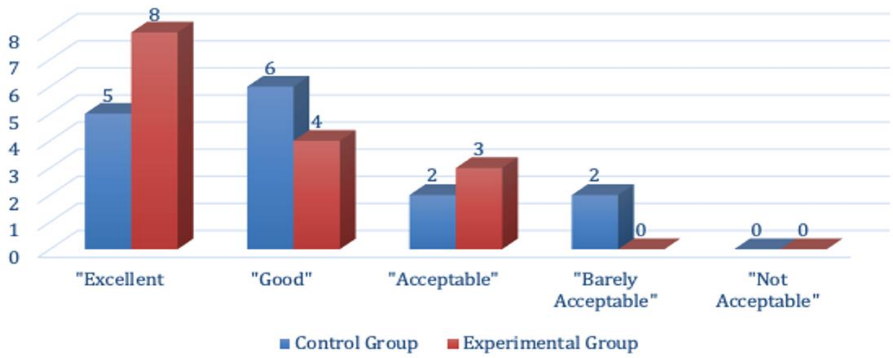

Figure 6. Graphical representation of students attitude toward visualization in both group.

The Figure 6 graph clearly demonstrated that students had a "outstanding" attitude toward visualisation accomplished through computers utilising Microsoft mathematics by the "experimental group," as seen by the "excellent" rating on the Figure 6 graph. Students in the "control group" had a "very positive" attitude regarding computers in general, even if they were in the "experiment group."

The purpose of this study was to determine whether integrating Microsoft Mathematics into instruction has a substantial impact on students' conceptual knowledge and attitudes. Students studying calculus demonstrated that they were up to the task of mastering difficult subjects, particularly in the sub-topics of differentiation, integration, trigonometry, algebra, and limits. Students' understanding capacity was poorer when they were taught using the traditional teaching style. When Microsoft mathematics was used in the classroom to assess students' learning abilities as well as their attitude toward it, the results were overwhelmingly positive. The findings demonstrated that MM improved students' conceptual skills as well as their attitudes toward learning. In their classroom tests, students did significantly better on both the individual and the group levels. Through the use of MM, the students have gained conceptual understanding. In order to answer the first question, we conducted a quantitative study with a sample size of thirty students. In reality, it is a hybrid study that incorporates both quantitative and qualitative methodologies. It was discovered that when Microsoft Mathematics was used in the classroom context, the students demonstrated excellent conceptual knowledge and demonstrated an overall better attitude. There were two primary groups in the quasi-experimental study: the control group and the experimental group. Students in the control group were exposed to and taught calculus principles in the traditional manner, whereas students in the experimental group were taught calculus concepts through the use of Microsoft mathematics visualisation plotting of 2D and 3D graphs of functions. Additionally, this study took use of a well-designed questionnaire developed by Fogarty et al. (2001). In the questionnaire, there were two main subjects to choose from: mathematics confidence and computer confidence. There were 11 questions pertaining to mathematics confidence, and 12 questions pertaining to computer confidence were included in the test. The students' mathematics confidence questions were given to them, and it was later demonstrated that the experimental group students had scored significantly better than the control group students because they had improved conceptual skills and attitudes in mathematics.

5. CONCLUSIONS

The primary purpose of this inquiry is to understand more about the advantages of using Microsoft Visualization Mathematics in the classroom and how to implement it. As previously said, research has demonstrated that incorporating technology into the classroom environment is more effective in terms of encouraging student learning. This study uses Microsoft maths to visualise several calculus concepts in the classroom to improve students' intellectual knowledge as well as their attitude toward them. Microsoft Mathematics is a free, open-source software programme that teaches basic calculus principles such as differentiation, integration, limits, statistics, trigonometry, and linear algebra. It is available on the Windows operating system. Microsoft Mathematics has offered a user-friendly interactive interface, as well as the ability to draw 2D and 3D diagrams of any function. Microsoft Mathematics has also supplied the ability to draw 2D and 3D diagrams of any function. It has contributed to the discipline of visualisation, which is a subfield of computer science that is focused with graphic visualisation. Whilst utilising Microsoft Mathematics to study different topics through visualisation, the software also allows students to comprehend mathematical concepts while using Microsoft Mathematics to understand mathematical problems Microsoft Mathematics includes innovative capabilities that allow kids to learn very quickly and effectively through images, which is not possible with conventional methods.

Students' conceptual comprehension of mathematics, as well as their attitude toward traditional mathematical instruction, are demonstrated in this research.... In addition, the software allows for the visualisation of many mathematical functions. Microsoft mathematical visualisation assists students in developing a better conceptual knowledge of mathematics, as well as better attitudes toward mathematics..

6. FUTURE WORK

Calculus will increase the conceptual understanding and attitudes of students regarding the study of the subject. It is more understandable than the traditional method. Students are given opportunities to learn calculus concepts and techniques through experiments and exploration. Which shows that it enhances the interest of students in the learning process. According to mathematics teachers, computers in mathematical education have broadened their teaching skills, but they have also made them more exciting and compelling. They can utilize Microsoft Mathematics when teaching in a classroom setting and improve the students' further conceptual understanding and problem-solving capacity. Moreover, teachers should use technology in the classroom in the learning process so that the students can be enabled to explore the mathematical world and take an interest in the subject. Teachers of mathematics should review the existing practices and they should use technology for teaching mathematics using effective and interesting strategies. Additional research and extension studies may also be conducted through other technological instructions, methods, and practices. Such as mathematical applications which can help students to improve their attitudes, critical thinking, analytical and logical reasoning in calculus and other mathematical related courses. Likewise, research work can be conducted on various programmes. Such as technical, vocational and engineering fields. The current research work and study was conducted on computer science students.

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