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Multimedia Courseware on Improving the Proficiency in Learning Mathematics at the IX standard

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Abstract:

The student's capacity for critical mathematical thinking is still quite limited. The switch from face-to-face instruction to online instruction in this instance is one of the contributing factors. Applying interactive multimedia-based learning is one way to combat this problem. This study evaluated the effectiveness of using multimedia technology to learn and teach mathematics in secondary schools. It was conducted in both private and public secondary schools in various regions. This study analysed the proficiency and engagement of secondary school students in learning mathematics after using multimedia courseware. This study aims to provide the idea and methodology for developing adaptive multimedia courseware based on multiple intelligence theory for a secondary school in learning and teaching mathematics. The utilization of multimedia technology in the classroom had a significant impact on the student's interest and performance in mathematics. Then, gauge how the use of interactive multimedia courseware is received by the students. Experts and practitioners should evaluate the viability of interactive multimedia courseware. Experts, educators, and students all participated in its research and development. A total of 481 surveys with expert validation sheets, teacher questionnaires, and student questionnaires are used to gather data from secondary school pupils. Data was gathered to answer the research questions using a pre-test, post-test, and customised questionnaire. Consequently, they were evaluated using descriptive statistical methods that included mean and percentage calculations. A t-test and an analysis of covariance were used to analyse the collected data. The software SPSS is used to analyse this work. It demonstrates that multimedia has a favourable effect on students' achievement and proficiency in mathematics. The study found that using multimedia in the classroom improved students' aptitude for solving mathematical problems. It is recommended that students should be actively involved in their education by regularly utilizing multimedia courseware that is pertinent and meaningful to them regularly.

Keywords: *Multimedia Courseware, Secondary Level Students, Learning Mathematics and Students Proficiency.*

1. Conceptual Work:

Social media is used by People in other countries to find out information [1]. Applications collectively referred to as "social media" (such as Face book, Twitter, WhatsApp, LinkedIn, YouTube, etc.) and websites that connect people through social networks to share information and inform people about events [2]. Today's educational organizations are witnessing a technological change in learning and teaching in several facets [3]. Nowadays students learn faster when teachers introduce a variety of innovative techniques into the classroom. Additionally, not all subjects make similar assessments. Therefore, various tools should be developed to build a better learning environment [4]. It has not grown for Academic research to become a blind eye to those changes, and there is already very vital work investigating the importance and extent of innovation in journalism from one-of-a-kind angles [5].The news media are exploring new methods of telling and ingesting information at the equal time the journalistic genres are rapidly being transformed [6]. The better learning experience presented in students' hobbies is one of the core elements in addition to higher academic success. Moreover, college students have no hobby to analyze mathematics subjects and their participation is low because of their dull gaining knowledge of approaches [7].Mathematics becomes boring when its concepts are irrelevant to real problems and are seen only as numbers [8].All fields, including analytical, scientific, engineering, financial, medical, and computer science, are seeing an increase in the importance of mathematics [9]. Even in our daily lives, estimating and simple math skills are crucial for schooling. This is a result of the fact that despite numerous new technologies in the domain of education are being created, adopted, and utilised [10]. It was still frequently insufficient to include IT Capability (ITC) to study and teach mathematics. One of the efficient learning methods investigated by ITC is multimedia learning [11]. Due to its properties of interaction, adaptability, and incorporation of many media elements that can support and raise students' motivation, interest, and confidence level, multimedia is very useful and productive in the learning of mathematics. To mediate and enhance knowledge and enhance learning and performance through the strategic design, management, and implementation of learning and instructional processes and resources, educational technology is defined as "the study of the application of theory, best practices, and research in an ethical manner.

Vocational high schools use technology, attitudes, life skills and practical skills holistically and link them [12]. This declaration is in line with Walter's opinion Walter, vocational schooling is an educational program that prepares college students to be prepared to face the arena of labor [13]. The studying system in schools is oriented to growing understanding competence. traditional learning with the lecture technique the instructors both at the elementary and upper school level is regularly utilized [14]. The cause of growing this proposed online multimedia courseware is to assist secondary faculty students in self-studying math courses and additionally assist their parents in an easier way to analyze math successfully to educate the students [15]. The effect of multimedia courseware on secondary school pupils' skilfulness and assimilation of mathematical information is therefore being researched. The remaining part of the work is structured as follows, section 2 demonstrates the literature survey of the study, and Section 3 exposes the problem definition and motivation of the research. Section 4 demonstrates the proposed research methodology, section 5 illustrates the experimentation and result discussion, and Section 6 portrays the conclusion of the study.

2. Literature

The mathematical model to evaluate the role of different types of media in mitigating the COVID-19 outbreak is proposed by Koutou *et al* [16]. The model takes into account standard incidence rates and suggests that social media such as TV, radio, Face book and Twitter can play an important role in preventing the spread of this disease. They have shown some numerical simulation results that correspond with our theoretical findings by using some available data from the literature. The data analysis technique described by Miles and Huberman (Reduction, Presentation, and Conclusion) was applied in this work by Hasanah *et al* [17]. The difficulties identified in certain students suggest that they do not yet possess a thorough comprehension of mathematical concepts and the skills necessary to learn mathematics from prior sessions. Shuligin *et al* [18] compared the impact of traditional approaches to mathematics education and the use of MalMath applications on student academic performance. The findings of this study corroborate data from other scientific studies showing that MalMath applications have a positive impact on student learning performance and motivation.

Nardi *et al* [19] considered some of the challenges university teachers face in engaging students from different communities in mathematics education as a discipline and proposed teaching and assessment approaches that address them. Results from two courses and sample her activities and student work from each course to demonstrate the use of the assessment framework and highlight lessons learned from using the assessment framework. A study by Graafsma *et al* [20] aimed to which program learning cognitive abilities play a role. Indicators demonstrated that memory-related language abilities and algorithmic skills are both important factors in determining overall programming success. Middle school is important because more kids struggle academically during this time, according to Bastian et al [21], and because organic changes in sleep frequently begin while children are in middle school. The outcomes emphasize the wider connections between academic and fitness results and recommend that policymakers want to put off-start instances for center grades college students.

The concept and knowledge of plane geometry proposed by Atta *et al* [22] impact the flipped classrooms which happen to be the main streams of mathematics as a methodology for preparing future teachers. The analysis based on the results of the null hypothesis rejected the pre-service teacher performance before and after the intervention to significantly differ statistically. Bruckler *et al* [23] evaluated the context of the epidemic in conditional probability reasoning for the false assumptions, probabilistic intuitions, fallacies, and prejudices of aspiring mathematics teachers. Consequences additionally divulge that pre-service arithmetic instructors curiously separate the content material realized in the school room for quintessential examination of the information from the software.

Frieder *et al* [24] evaluated ChatGPT's mathematical skills by evaluating it on both manually created and publically accessible datasets and comparing its performance to other models trained on a mathematical corpus, such as Minerva. According to the data, ChatGPT frequently understands the query but fails to deliver correct answers. According to Lim *et al* [25], it is critical to research the effectiveness of adaptive learning systems, at the very least in connection to course grades when assessment stakes are included, for accountability purposes. The study's findings showed a difference in course grades, demonstrating the benefit of using the internal adaptive learning system, however, the difference was not statistically significant at the 95% confidence level.

3. Theoritical Aspects of the Study:

The fast-changing educational paradigm is impacted by the rapid growth of digital technology. Contrarily, education is vital in helping children build strong, moral character. The majority of pupils, particularly those in secondary school, show little to no enthusiasm for the study of mathematics. Since mathematics is a challenging topic, teachers have looked for more engaging ways to teach it to students to raise their maths performance. However, the classroom for mathematics has been significantly impacted by multimedia technologies. Mathematical topics that were previously too hard for traditional classroom settings can now be explored in-depth thanks to the use of multimedia, especially when "messy data" from the real world is involved. Students can study concrete representations of mathematical topics visually enabled by multimedia. Utilizing the graphing calculator would give the student a real learning opportunity to identify their thought processes, methods, and organizational structure, allowing them to go to a higher, more formalized level of understanding.

It is possible to employ multimedia technology ways of teaching mathematics as a teaching tool rather than as a preconception. Students' capacity for logical reasoning is shaped through their study of mathematics. The teaching process requires skill, means, and method knowledge. Due to its significance in the field of science and technology, mathematics is declared a required subject at the basic and secondary levels of education in many nations throughout the world.The fundamental purpose of multimedia courseware is to help students understand and overcome their learning challenges through the use of sounds, visuals, and other media. Students become familiar with gaining new knowledge by using multimedia technology to create instructional circumstances that take advantage of their pre-existing cognitive structures. As a result, interactive multimedia courseware can enhance student learning, and because it offers interesting content and interactivity, students will be more inspired to learn on their own. This suggested online multimedia courseware was created with two goals in mind: to aid secondary school students in their independent study of maths courses, as well as to assist their parents in instructing them in maths in a more effective manner.

4. Method:

In facilitating individual and group learning, managing and administering classroom activities and the learning content, and simulating real-world issues in various settings, multimedia has improved access for teachers and students in remote locations. Various educational institutions from all levels and across the globe have employed and experimented with multimedia technology in the context of their designs. Students who received instruction via multimedia were categorized as the experimental group, while those who received instruction using traditional methods were categorized as the control group.The students were made aware that completing the questionnaire was entirely voluntary and that failing to do so would not result in any consequences, but that doing so would aid the study's success.

4.1 Research Design:

The quasi-experimental design is used in the investigation. It used a factorial design with a pre-test and post-test, non-randomized, non-equivalent control group. The study employed a non-equivalent pretest-posttest control group design. An experimental group that received instruction in linear equations in mathematics and received an assessment to track the students' development are the two groups that make up the study. The primary independent variable identified in this study was the use of Multimedia Courseware incorporating Cooperative Learning (MC) in the teaching of mathematics.

4.1.1. Hypothesis

The hypothesis of the research work is presented as follows.

- There is a significant difference between the performance of male and female students.
- The use of multimedia technology in the classroom has a favorable effect on students' interest in and proficiency in mathematics.
- There is a positive correlation between multimedia courseware on secondary school students' proficiency and engagement in learning mathematics.

4.1.2.Research Procedure

The experimental group's treatment tool was multimedia courseware (MC) on mathematical word problems involving linear equations. The performance of the pupils was categorized into high, medium, and low score levels using their pre-test results. High-scoring students were those who had a score of 70% or above, medium- or average-scoring students were those who received a score between 50% and 69%, and low-scoring students were those who received a score between 0% and 49%. Within three weeks, the instrument dependability was evaluated using the test-retest procedure. Using Pearson Product Moment Correlation Statistics at a 0.05 alpha level of significance, a reliability coefficient of 0.760 was calculated.

4.1.3. Research Data Collection

A questionnaire was developed to enable gathering the necessary data for analysis before starting the research for the assessment of teaching mathematics using multimedia technology methods in secondary schools in India. 481 students were selected at random from private and public secondary schools to represent the sample in this study. After teaching the same topic in mathematics to the students over time using both the standard teaching approach and the multimedia technology method, the questionnaires were given to them to complete.The students were made aware that completing the questionnaire was entirely voluntary and that failing to do not result in any consequences, but that it will aid the study's success.

Table 1: Demographic Details of Respondents

Demographic	Characteristics	No. of Respondents	Percentage
Gender	Male	272	56.5%
	Female	209	43.5%
Age	13	56	11.642%
	14	231	48.025%
	15	194	40.333%
Standard	9	251	52.18%
	10	230	47.82%
School	Public	177	36.8%
	Private	304	63.2%
Test	Pre-Test	290	60.2%
	Post-Test	191	39.8%
Group	Experimental Group	288	59.9%
	Control Group	193	40.1%

A post-test with ten questions from the chosen Mathematics topic that was presented utilizing both teaching modalities was also given to the students. Table 1 lists the respondents' demographic information, including their gender, age, standard, test, and group. At the ages of 13, 14, and 15, 272 male students and 209 female students are selected for this study. Pre-tests and post-tests based on the experimental group and control group were administered in this survey. Students who received instruction via multimedia were categorized as the experimental group, while those who received instruction using traditional methods were categorized as the control group.Over twenty (20) points were awarded for the post-test findings, with two (2) points given for each correctly answered question. To test the stated null hypothesis, the post-test data were analyzed using the paired samples t-test. The results of the questionnaires collected were analyzed by finding the frequencies in the percentage of the responses to each of the questions with a pie chart illustrating the most preferred method of teaching by the students in their mathematics class.

4.2. Research Methodology:

The motivation level of the students to learn mathematics is examined in this study using a survey methodology. The Instructional Material Motivation Survey (IMMS) was modified to create the questionnaire. 481 pupils (209 females and 272 males) and teachers who instruct form two mathematics make up the study's population. The survey was split into two parts, with the first session consisting of an hour of learning using the maths courseware and the second session consisting of 30 minutes of survey completion. The Ministry of Education provided the maths curriculum for form two that was employed in this study. One computer was given to each pupil so they could learn independently. A test was given to them after the session to gauge how well they understood the subject. There are 35 questions in the survey form. A five-point Likert scale with the values "1 = strongly disagree" and "5 = strongly agree" was used to gauge the students' degree of agreement and disagreement with several topics. The researcher observed the teacher while she conducted the survey session. The teacher goes over the instructions that the pupils must follow early in the class. Following analysis of the collected data, descriptive statistics were calculated.

4.2.1. Multimedia Mathematics Courseware Framework

To ascertain the audience's needs or problems and how to address them, a need analysis is carried out. The task analysis is carried out to determine the required knowledge or expertise. The Ministry of Education's most recent syllabus can be used to analyze the subject's content. Then, it is determined what needs to be learned by performing the instructional analysis. The learner analysis is finished. Because domain trigonometry in the secondary school mathematics curriculum is one of the hardest topics for form four pupils, this subject was chosen for the courseware's content. The design phase will make use of the analysis phase's data.Identifying learning objectives, figuring out how the objectives will be reached, and creating instructional specifications are all tasks that fall under this phase. Evaluation plays a significant role in this phase as well. The designer must decide how and how well objectives will be evaluated.

4.2.2. Incorporating Multiple Intelligences into Multimedia Mathematic Courseware

The courseware is designed to be a self-contained, stand-alone learning module that makes the most of multimedia to engage students with various levels of intelligence. Designing educational courseware to facilitate successful learning requires careful consideration of how the materials are presented. The activities offered in the courseware determine if it is successful.

Verbal/Linguistic: Use of text as a medium, crossword puzzle, and problem-based activity

Logical/Mathematical: Use games, an inductive approach, problem-solving techniques, and calculating software.

Musical/Rhythmic: Rhythm, sound, and music are used for teaching, creating musical instruments, and creating recording programs.

Visual/Spatial: Use of charts, mind maps, visual and drawing activities, the building of 2D or 3D programs, and puzzles.

Bodily-Kinesthetic:letting the user move things across the computer screen and enter data using a joystick, keyboard, touch screen, or mouse.

Interpersonal: Use of games, chat rooms, email, and group discussions.

Intrapersonal: Recording tools, practice routines, video cameras, diaries, and journals can all be used.

Naturalist: Using natural resources to help students learn, such as plants, animals, fauna, and flora.

4.3. Research Data Analysis

Ten-word puzzles utilizing linear equations, some of which ask about age, consecutive integer problems, digit problems, geometry word problems, and fraction and proportion problems, were included in both the pre-test and the post-test. Each test was handed to students in each group, and they had 40 minutes to do it. Both the pre-test and the post-test used a common marking method to be scored.

4.3.1. Research Questionnaire

The use of 48 closed-ended questions to gauge students' involvement (participation and involvement) in the learning and teaching of mathematics included both negative and positively worded items. The items required students in both groups to select from the options on a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree). Students in both groups were also allowed to present this work to the class, work in groups in class, and listen to the teacher's lecture throughout the lesson. Before and after the treatment, the questionnaire was given out.Utilizing both inferential and descriptive statistics, the data were arranged and examined.

4.3.2. Validity and Reliability of Instruments

The senior lecturers of the mathematics education department at the University of Education, Winneba, analyzed and processed the content validity of the MC, test, and questionnaire items. A pilot study was carried out to ascertain the instrument's dependability as well. Using a small sample of 20 forms 1 SHS students who are representative of the study's participants, the teacher piloted the instrument. The instrument's reliability (Cronbach's Alpha value) was 0.783, indicating that the questionnaire's items were very reliable.

5. Discussion:

The variables of the research are Multimedia Based Teaching and Learning (MTL), Students' Interest(SI), Student Engagement (SE), Student Thinking Ability (TA), Mathematics Proficiency (MP), and Performance in Mathematics Achievement (PMA). 481 data are collected for this study. The data from the questionnaires were analyzed using the Statistical Package for the Social Sciences (SPSS) program. For descriptive analysis, regression, and correlation analysis, a structured SPSS-based data collection was employed. In the statistical model, the link between the independent and dependent variables is estimated. As a result, the following table 2 lists the simulation tools that were employed for the suggested system.

Table 2: Simulation System Configuration

SPSS Statistical Tool	Version 23.0
Operation System	Windows 10 Home
Memory Capacity	6GB DDR3
Processor	Intel Core i5 @ 3.5GHz

Only 4% of the students who attempted all the items on the pre-test, a full 75% of them got the right response. However, on the follow-up test, 86% of participants attempted every item, and only 45% got it right. The pupils performed significantly better on each of the post-test items than they had on the pre-test. After using the teaching strategies, the post-test results showed that the majority of students (72%) could read, interpret, convert the statement into algebraic form, and resolve mathematical problems. These may have boosted their performance by causing them to receive higher points on the post-test. Nevertheless, the experimental and control groups' respective pre-test mean scores were 49.62 and 44.50, whereas their post-test mean scores were 66.10 and 58.48, respectively. Additionally, the experimental and control groups' mean gain scores were 16.48 and 13.98, respectively. The experimental group had a greater mean gain score than the control group, with a 2.50 difference in mean gain scores between the two groups.

Table 3: Pre-test and Post-Test Experimental and Control Groups

		Pre-test		Post-test		Mean GainScore
Groups	**N**	**Mean**	**Std. Dev.**	**Mean**	**SD**	
Experimental	191	51.65	20.18	67.19	17.48	17.91
Control	290	47.89	11.16	56.53	14.11	14.61

Table 3 displays the descriptive statistics of the pre-test results for the experimental and control groups of the study's participants in arithmetic.

5.1. Validity/ Pearson Product Moment/Correlation Statistics

The intensity and direction of the link between two variables that are measured on at least an interval scale is shown by the Pearson product-moment correlation coefficient, or Pearson's correlation.

Table 4: Product Moment/Correlation Coefficient

		MTL	SI	SE	TA	MP	PMA
MTL	Pearson Correlation	1	.070	.102	.036	.130**	.110**
	Sig. (2-tailed)		.125	.971	.431	.511	.825
	A sum of Squares and Cross-products	16652.994	1166.503	36.387	612.975	2673.788	1692.595

	Covariance	34.694	2.430	.076	1.277	1.027	.353
	N	481	481	481	481	481	481
SI	Pearson Correlation	.070	1	.120**	.022	-.100*	.005
	Sig. (2-tailed)	.125		.009	.633	.028	.909
	A sum of Squares and Cross-products	1166.503	16634.748	2658.193	372.012	-1641.106	87.297
	Covariance	2.430	34.656	5.538	.775	-3.419	.182
	N	481	481	481	481	481	481
SE	Pearson Correlation	.102	.120**	1	.173**	-.007	-.045
	Sig. (2-tailed)	.971	.009		.000	.885	.325
	A sum of Squares and Cross-products	36.387	2658.193	29618.025	3922.453	-144.852	-1003.865
	Covariance	.076	5.538	61.704	8.172	-.302	-2.091
	N	481	481	481	481	481	481
TA	Pearson Correlation	.036	.022	.173**	1	.141**	-.102*
	Sig. (2-tailed)	.431	.633	.000		.002	.025
	A sum of Squares and Cross-products	612.975	372.012	3922.453	17429.900	2368.848	-1746.378
	Covariance	1.277	.775	8.172	36.312	4.935	-3.638
	N	481	481	481	481	481	481
MP	Pearson Correlation	.130**	-.100*	-.007	.141**	1	.168**
	Sig. (2-tailed)	.511	.028	.885	.002		.000
	A sum of Squares and Cross-products	2673.788	-1641.106	-144.852	2368.848	16152.790	2778.216
	Covariance	1.027	-3.419	-.302	4.935	33.652	5.788
	N	481	481	481	481	481	481
PMA	Pearson Correlation	.110**	.005	-.045	-.102*	.168**	1
	Sig. (2-tailed)	.825	.909	.325	.025	.000	
	A sum of Squares and Cross-products	1692.595	87.297	-1003.865	-1746.378	2778.216	16834.649
	Covariance	.353	.182	-2.091	-3.638	5.788	35.072
	N	481	481	481	481	481	481
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

Table 4 displays the Pearson product-moment correlation coefficient. This test demonstrates that there is less influence on multimedia courseware in the student interest and their performance in Mathematics. Its correlation coefficient value is .070, and 0.110**. This depicts that there is a positive correlation between Multimedia technology student interest and their performance in Mathematics. The results of the analysis for the research hypothesis, which was tested using a t-test. However, it satisfies hypotheses 2 and 3. That there is a higher correlation between multimedia courseware on students' mathematics proficiency and their engagement in learning mathematics. It achieves a higher correlation of 0.130**, and 0.102, respectively.

Table 5: Boys and Girls Pearson Correlation Coefficient

		BMTL	**GMT**	**BMP**	**GMP**	**BPMA**	**GPMA**
BMTL	Pearson Correlation	1	-.008	.131**	-.035	.117**	.031
	Sig. (2-tailed)		.864	.004	.445	.010	.491
	N	481	481	481	481	481	481
GMT	Pearson Correlation	-.008	1	.127**	.006	-.098*	.063
	Sig. (2-tailed)	.864		.005	.899	.032	.168
	N	481	481	481	481	481	481
BMP	Pearson Correlation	.131**	.127**	1	.018	-.016	-.058
	Sig. (2-tailed)	.004	.005		.691	.721	.205
	N	481	481	481	481	481	481
GMP	Pearson Correlation	-.035	.006	.018	1	.144**	.117*
	Sig. (2-tailed)	.445	.899	.691		.002	.010
	N	481	481	481	481	481	481
BPMA	Pearson Correlation	.117**	-.098*	-.016	.144**	1	.112*
	Sig. (2-tailed)	.010	.032	.721	.002		.014
	N	481	481	481	481	481	481
GPMA	Pearson Correlation	.031	.063	-.058	.117*	.112*	1
	Sig. (2-tailed)	.491	.168	.205	.010	.014	
	N	481	481	481	481	481	481
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

Table 5 reveals the Pearson correlation coefficient between boys' and girls' multimedia courseware learning and their academic achievement in mathematics. This result depicts that there is a significant difference between the performance of male and female students. However, there has less correlation between boys' and girls' multimedia utilization and their academic performance.

5.2. Reliability Analysis

The reliability coefficient provides information about a test's dependability. Indicated by the letter "r," it is stated as a value from 0 and 1.00, with r = 0 signifying no reliability and r = 1.00 signifying excellent dependability.

Table 6: ReliabilityTest Results

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.760	.153	6

The reliability statistics in Table 6, which is the first significant table and is included in the above table, offer the real value for Cronbach's alpha. Simply put, Cronbach's alpha gives you the overall dependability coefficient for a group of factors (such as questions). The Cronbach's alpha, which shows a high level of internal consistency for this scale for this particular sample, is 0.760.

Table 7: ANOVA with Friedman's Test

<table>
<tr><th colspan="2"></th><th>Sum of Squares</th><th>df</th><th>Mean Square</th><th>Friedman's Chi-Square</th><th>Sig</th></tr>
<tr><td colspan="2">Between People</td><td>21797.694</td><td>480</td><td>45.412</td><td></td><td></td></tr>
<tr><td rowspan="3">Within People</td><td>Between Items</td><td>55.921[a]</td><td>5</td><td>11.184</td><td>1.469</td><td>.917</td></tr>
<tr><td>Residual</td><td>91525.412</td><td>2400</td><td>38.136</td><td></td><td></td></tr>
<tr><td>Total</td><td>91581.333</td><td>2405</td><td>38.080</td><td></td><td></td></tr>
<tr><td colspan="2">Total</td><td>113379.027</td><td>2885</td><td>39.299</td><td></td><td></td></tr>
<tr><td colspan="7">Grand Mean = 19.08</td></tr>
<tr><td colspan="7">a. Kendall's coefficient of concordance W = .000.</td></tr>
</table>

The non-parametric substitute for the one-way ANOVA with repeated measures is the Friedman test is depicted in Table 7. In situations when the dependent variable being measured is ordinal, it is utilized to examine changes across groups. It can also be applied to continuous data that deviates significantly from normality and hence cannot be utilized to perform a one-way ANOVA with repeated measures. All the studiesneed to report the outcome of the Friedman test as 1.469 is the test statistic (2) value ("Chi-square"), degrees of freedom ("df"), and significance level ("Asymp. Sig.") of 0.917 from the table above. The mean ranks of the associated groupings differ overall in a statistically significant way. It is crucial to note that, the parametric counterpart, the Friedman test is omnibus; it determines whether there are general differences but does not specify which groups specifically differ from one another.

Table 8: Intraclass Correlation Coefficient

	Intraclass Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.031[a]	.007	.058	1.191	480	2400	.006
Average Measures	.160[c]	.038	.271	1.191	480	2400	.006
Two-way mixed effects model where people effects are random and measures effects are fixed.							
a. The estimator is the same, whether the interaction effect is present or not.							
b. Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.							
c. This estimate is computed assuming the interaction effect is absent because it is not estimable otherwise.							

Table 8 illustrates the intraclass coefficient of the reliability test. If the rating scale is continuous or ordinal, then the Intraclass Correlation Coefficient (ICC) can be used to assess the level of inter-rater agreement. It performs well in studies with two or more raters. It should be noted that the ICC can also be used for intra-rater reliability analysis (multiple scores from the same raters) and test-retest reliability analysis (repeated measures of the same subject). The test's significant results are 0.006. The intra-class correlation coefficient, which was often calculated to evaluate the consistency between two measures in grading the confidence interval of participants, is 0.031 and.160, respectively.

5.3. Descriptive Statistics

The fundamental characteristics of the data in a study are described using descriptive statistics. Simple summaries of the sample and the measurements are provided. They serve as the foundation for almost all quantitative studies of data, along with straightforward graphical analysis.

Table 9: Descriptive Statistics of Students

	N	Minimum	Maximum	Mean	Std. Deviation
MTL	481	9	54	19.26	5.890
SI	481	8	32	18.87	5.887
SE	481	7	124	19.24	7.855
TA	481	4	32	19.05	6.026
MP	481	8	39	19.09	5.801

PMA	481	9	30	18.97	5.922
Valid N (listwise)	481				

Table 9 displays descriptive statistics on students' gains on the pre-and post-tests for the two groups (experimental group and Control group). The findings showed that the component of students' learning skills had the lowest mean value, 18.87, while multimedia-based learning had the highest mean 19.26. The variables MTL, SI, SE, TA, MP, and PMA, however, have standard deviations of 5.89, 5.887, 7.855, 6.026, 5.801, and 5.922, respectively.

Table 10: Statistics Test Analysis

		MTL	SI	SE	TA	MP	PMA
N	Valid	481	481	481	481	481	481
	Missing	0	0	0	0	0	0
Std. Deviation		5.890	5.887	7.855	6.026	5.801	5.922
Skewness		.600	.321	5.231	.229	.327	.204
Std. Error of Skewness		.111	.111	.111	.111	.111	.111

The categorical variables under examination are summarized in Table 10. Where N stands for the total number of observations, and the table illustrates the validity of the observations and any missing values in the data. They can determine that 481 students make up the sample for the chosen variables from the output displayed above. The variables MTL, SI, SE, TA, MP, and PMA have standard deviations of 5.890, 5.887, 7.855, 6.026, 5.801, and 5.922 respectively. The standard error of the skewness is depicted as 0.111 because the lowest and highest skewness values are 0.204 for PMA and 5.231 for SE, respectively.

5.4. T-Test Analysis for Hypothesis Testing

A statistical test called a t-test contrasts the means of two samples. It is employed in hypothesis testing where the alternative hypothesis is that there is a difference between the group means, as opposed to the null hypothesis, which is that there is no difference between the group means.

Table 11: One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
MTL	481	19.26	5.890	.269
SI	481	18.87	5.887	.268
SE	481	19.24	7.855	.358
TA	481	19.05	6.026	.275

MP	481	19.09	5.801	.265
PMA	481	18.97	5.922	.270

The sample t-test, also known as the single sample t-test, is a statistical hypothesis test designed to ascertain whether the mean estimated from sample data is obtained in Table 11. Although both are valid, it is more frequent to give descriptive statistics using the mean and standard deviation ("Std. Deviation" column) as opposed to the standard error of the mean ("Std. Error Mean" column). The variables MTL, SI, SE, TA, MP, and PMA have standard deviations of 5.890, 5.887, 7.855, 6.026, 5.801, and 5.922 respectively. Therefore, the corresponding standard error mean values for these variables are 0.269, 0.268, 0.358, 0.275, 0.265, and 0.270.

Table 12: One-Sample Test

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
MTL	71.721	480	.000	19.262	18.73	19.79
SI	70.297	480	.000	18.869	18.34	19.40
SE	53.721	480	.000	19.241	18.54	19.94
TA	69.325	480	.000	19.048	18.51	19.59
MP	72.187	480	.000	19.094	18.57	19.61
PMA	70.263	480	.000	18.973	18.44	19.50

The t-value was significant at the 0.05 alpha level, per the analysis's findings, as shown in Table 12. This suggests that the experimental group outperformed the control group and that there was a sizable difference in performance between the two groups. The first hypothesis was thus disproved, indicating that employing multimedia courseware improved students' performance in word problems requiring linear equations. The lowest t-value for PSS is 53.721, and the highest t-value for MP is 72.187. The significance level, in this case, is 0.000. Their mean difference is 19.241 and 19.094, respectively.

5.5. Analysis of Covariance

When a third variable referred to as the covariate exists that can be measured but not controlled and that has a clear impact on the variable of interest, analysis of covariance (ANCOVA) is a technique for comparing sets of data made up of two variables (treatment and effect, with the effect variable being referred to as the variate).

Table 13: Tests of Between-Subjects Effects

Dependent Variable: MP					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	1423.107[a]	27	52.708	1.621	.027
Intercept	7363.517	1	7363.517	226.459	.000
PMA	408.604	1	408.604	12.566	.000
SE	964.619	26	37.101	1.141	.289
Error	14729.683	453	32.516		
Total	191508.000	481			
Corrected Total	16152.790	480			
a. R Squared = .088 (Adjusted R Squared = .034)					

The results of the ANOVA test are shown in Table 13. Actual results of the two-way ANOVA, specify whether either of the two independent variables or their interaction is statistically significant. In particular, the "mathematics achievement" and "problem-solving skill" rows are of significance. These rows let us know whether the dependent variable, "interest in politics," and our independent factors, "gender" and "education_level" rows, have a statistically significant impact on it. The "Sig." column indicates that there is a statistically significant interaction at p = 0.000. According to the table above, there was no statistically significant difference between students' mean interest in politics and their aptitude for maths (p =.000) and their mean interest in their ability to solve problems (p =.289).

6. Conclusion:

The fast-changing educational paradigm is impacted by the rapid growth of digital technology. On the other hand, education has a crucial role to play in developing students with good, and solid character. This study intends to describe the idea and structure of interactive multimedia courseware, assess the viability of such courseware for experts and practitioners, and gauge student reactions to such courseware. Data on 481 students are initially collected via a questionnaire method. The students' mathematical learning engagement and proficiency are evaluated using multimedia courseware.This study analyzed the usage of multimedia technologies in the classroom that impacted the students' interest and performance in learning mathematics.Utilizing the SPSS program, the work is analyzed. Since students can easily understand the content compared to reading it in a textbook, the usage of multimedia courseware has improved teaching and learning environments. The results of the study revealed a substantial difference between the performances of students who received conventional instruction and those who used multimedia courseware. The performance of male and female students also differed significantly, with the males who used multimedia course materials surpassing their female counterparts. The outcome of the descriptive statistics revealed that the multimedia method had a higher mean score than the conventional method. Additionally, the outcome of the paired sample t-test analysis revealed a significant difference between the mean scores of the two instructional approaches. Thus, multimedia technology utilization in the classroom has improved student performance and increased their interest in mathematics. The study found that the usage of multimedia courseware has a favorable impact on students' mathematical performance and proficiency. This would serve as a basis for finding more general conclusions concerning the use of multimedia courseware in teaching and learning. The studies' findings demonstrate that multimedia courseware support can enhance secondary school students learning efficiency and significantly improve students' proficiency.

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