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THE EFFECTIVENESS OF INTERACTIVE MULTIMEDIA COURSEWARE AS INSTRUCTIONAL MEDIUM FOR TEACHING

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ABSTRACT- *This study looked at the comparative analysis of the performance of pupils who were taught multiplication of fractions using interactive multimedia courseware and those who were taught using the traditional teaching model. Visual Basic.Net, Captivate and TechSmith Camtasia Studio v5.0.2 were used to develop the interactive multimedia courseware on multiplication of fractions. The research instrument was in the form of a teacher made test and questionnaire. The test consisted of pre-test and a post-test where the test items difficulty were paralleled. The simple random sampling method was used to select 72 primary five pupils (36 pupils each from the two primary five classes). Frequency, percentages, Chi-square and t-test were used for the Data analysis. The results showed that there was no significant difference in the performance of the experimental group and the control group, but there was significant difference in pupil's interest in multiplication of fractions in the experimental group and the control group.*

KEYWORDS: Multimedia Courseware, Instructional Medium, Teaching

INTRODUCTION

Since the independence of Ghana in 1957 every ruling government had made the effort to improve upon the development of education. The various educational committees, Acts and reforms are the confirmation. Although, all the reforms were geared towards the improvement of the standard and performance of education, on the average, the performances of students over the years do not justify the effort put in the development of education[3]. In their presentation "Comparative analysis of performance of eighth graders from six African countries" on the outcome of the 2003 TIMSS result stated five Contextual factors that influenced the poor performance. One of the five Contextual factors was "little use of technology (that is, computers and calculators' in the science and mathematics curricula)". This meant that an increase in the use of technology will positively influence pupils' performance in both mathematics and science.

A report titled Idaho Technology Initiative [15] concluded that there exists enough evidence to say that technology has significant

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benefits on educational performance. Research has proving that managed courseware and electronic portfolios benefit both teacher and student, in terms of motivation and variety of manipulative materials. This promotes learning and self-assessment [11]. Multimedia Courseware is an electronic learning material that could be an entire "package" consisting of one 'class' or 'course' bundled together with the various lessons, tests, other material needed and it could be displayed in the form of text, video, sound, and various forms of animations. The designing steps [18]. are presented below :Definition of Education programme, Set Course Goals, Select and Analyse Course content, Design and Arrange Course Content, Understand and estimate student's goals and Characteristics, Select effective instructional modes,. Suggest readings and activities, Write the syllabus, Get feedback from students, Get advice from colleagues and other field experts. [8] Adequacy chart listed five aspects in evaluating courseware, these are; Instructional Adequacy, Curriculum Adequacy, Cosmetic Adequacy, Technical Adequacy and Adequacy of the development process.

Statement of the Problem

The unimpressive performance of the public basic schools in mathematics is shown in the BECE WAEC summary report (2004 - 2009). It revealed that majority of pupils performed below the national average of 62.42%. Again, the report on 2005 administration of national education assessment on primary 3 and primary 6 in English and Mathematics (2006) The report stated that the bulk of effort to improve teaching and learning to enhance learner achievement should be directed to areas with scores below 30% and especially those with scores below 25%.

The national education assessment on primary 3 and primary 6 in Mathematics (2006) drew attention to the areas of the mathematics curriculum in which the pupils are weakest and performed rather poorly. It showed that with the exception of comparing fractions, and changing a common fraction to a decimal (and vice versa), all the topics under fractions need appropriate remediation for objectives with scores below 31% and below 25%. Therefore, it is clear that pupils in the public basic schools have difficulty in solving problems involving fractions. According to Gould (2006); Hiebert (1988) and NAEP (2005), teachers and researchers typically described the teaching and learning of fractions as a challenging area in the mathematics curriculum.

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Table 1: Summary of Basic Education Certificate Examination (2004–2009)

Year	No. of District	% of Candidates with Aggregate 6-30	>30	National Average (N.Ave)	% of Candidates with Aggregate 6-30 above
2004	110	61.2	38.8	61.18	(22.7%)25
2005	110	61.6	38.4	61.59	(21.8%)24
2006	113	61.9	38.1	61.91	(23.0%)26
2007	138	61.3	38.7	61.28	(28.3%)39
2008	138	62.2	37.8	62.17	(30.4%)42
2009	138	62.4	37.6	62.42	(34.1%)47
Average	124.5	61.8	38.2	61.65	(26.7%)34

Purpose of the Study

The purpose of the study was:

1. To ascertain the effectiveness of Multimedia Courseware as a medium of instruction in the classroom.
2. To ascertain the influence of interactive Multimedia Courseware on pupils' performance.
3. To investigate pupils interest and satisfaction with the use of an interactive Multimedia Courseware.

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Research Questions and Hypothesis

This study was guided by the following hypothesis and research questions:

1. There is no significant difference in learner performance in the control group and experimental group in Multiplication of Fraction
2. There is no significant difference in the development of learner's interest in multiplication of fractions in the control group and experimental group.
3. Will learners be satisfied with the use of courseware as a teaching and learning aid for Multiplication of Fraction?
4. Could Learners learn multiplication of fraction using Multimedia Courseware without the support of the teacher?

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Significance of the Study

This study provided an insight on interactive multimedia courseware used as a learning medium. This study provides curriculum developers and educational administrators an appropriate teaching approach (collaborative method) when Multimedia courseware is used as the teaching and learning medium. The findings of this study are useful to teachers, parents and curriculum developers.

Studies on the Effectiveness of Courseware

[19] Reviewed 311 research studies on the effectiveness of technology on student achievement. Their findings revealed positive and consistent patterns when students were engaged in technology-rich environments, including significant gains and achievement in all subject areas, increased achievement in preschool through high school for both regular and special needs students, and improve attitude toward learning and increased self-esteem. [12] Said that e Learning could improve school results. Furthermore, a simple multimedia presentation helped the students to better understand a subject without the help of a teacher particularly for shy and weak students. According to [2], the significant role of technology in teaching and learning is limited as an instructional delivery medium and not a key determinant of learning. It can only support the classroom learning.

RESEARCH METHODOLOGY

Design

This study is an experimental research which employed the static-group comparison design. Two pre-existing groups (i.e. class 5A and B) were compared. The control groups were taught multiplication of fractions without the use of the interactive Multimedia Courseware. The Experimental groups were taught multiplication of fractions using the interactive Multimedia Courseware. This design is a weak design because the differences may exist for other reasons. This deficiency was corrected by administering a pre-test to establish the entry behaviour of the two groups, before the interventions were applied. Figure 1, shows the diagram of this design.

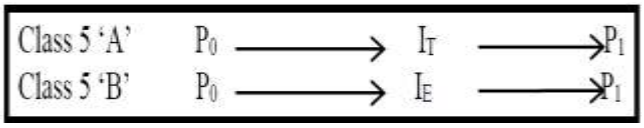

Figure 1 Research Design Diagram

P0 = Pre-test
P1 = Post-test
IT = Pupils taught without interactive multimedia courseware as teaching and Learning aid
IE = Pupils taught with interactive multimedia courseware as teaching and Learning aid

Population

The target population was Assin Foso Training College Demonstration Primary School Basic five pupils. The total population of the two streams of primary five was 90 pupils. Out of the 90, 53 were females representing 59% and 37 males representing 41%. Each class was made up of 45 pupils. Out of the 45 pupils of the" A" class 28 were females representing 62.2% and 17 males

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representing 37.8%. For the "B" class 25 of them were females representing 55.6% and 20 males representing 44.4%. The minimum and maximum age range of the population for the study was 10years to 13years. The mean age of population was 10.8 and the standard deviation was 0.15.

Sample and Sampling Method Technique

Thirty six pupils each, were selected for the control group (that is class 5A) and experimented group (that is class 5B) to make up the total sample of 72. Class 5B was considered as the experimental group and class 5A was considered as the control group. A simple random was then used to select 36 pupils each from the clusters(that is ,class 5A and 5B) to make up the total sample of 72., Out of the 36 pupils of the Control group (class 5A), 21 were females representing 58% and 15 males representing 42%. Out of the 36 pupils of the Experimental group (class 5B), 17 were females representing 47% and 19 males representing 53%.

Instrument

- *Description of the pre-test and post-test for both control and experimental groups*

  Teacher made test was used for both the pre-test and the post-test. The two tests were parallel in terms of difficulty because they were all taken from Mathematics for Primary Schools Ghana, Pupils Book 5 [4]. Each of the two tests was made up of ten questions. The face and content validity of the Test items was established by a mathematics lecturer at the University of Cape Coast, Ghana at the department of Basic Education Questions 1, 2, 9 and 10 were adjusted and further more advised to add unit fractions to the questions. A pilot test was conducted on the 2008/2009 academic year batch of Assin Foso demonstration primary school to measure the reliability of the test items. For both pre-test and post-test, Spearman-Brown prophecy formula was used to calculate the reliability which was 0.6 and 0 .65 respectively.

- *Description of the questionnaire to elicit pupil's impression on the effectiveness of the courseware*

  Questionnaire was used to assess the impression of both the Control group and the Experimental group. The questionnaire is made up of 5 items. The first two items in the questionnaire assessed the interest of the experimental group in using the courseware to learn multiplication of fractions. The third item in the questionnaire assessed how good the courseware design, content and lesson organisation was to pupils. The fourth item in the questionnaire assessed how satisfied were the control group and experimental group with the teaching activates.

- *The organisation of the learning process of the experimental group*

  The orientation and the five lessons of experimental group took place at the Assin Foso Training College computer laboratory. Each person was assigned to a computer. Pupils were taken through the usage of the entire program. They were taught the navigation tools of the software, and how to navigate through the software, login and registration process, how to play the game and how to take the test. Pupils were given strict guidelines to complete each unit before moving on to the next unit during the lessons. Pupils were advised not to jump the lessons. They were allowed to learn at their own pace. Any pupil who had difficulty in the learning process called for support from the facilitator. Pupils' activities were monitored throughout the lesson and assisted when necessary by the facilitator. Each lesson was concluded with at least 5 minutes peer to peer collaboration and minimum 5 minutes overall discussion of the lesson with the teacher. This

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encompasses individual difficulties, findings and suggestions. Each pupil was given a copy of the program on compact disk (CD) for keeps. The CD was prepared having in mind that not all pupils could get access to a computer. The CD given to the pupils could also be played on a VCD and DVD deck player. This was to provide pupils the opportunity to practice after the lesson at home.

A Model for Integrating Courseware in the Classroom

Step 1: Teacher /Instructor introduce Lerner's the courseware. Under the guidance of the teacher pupils spend some minutes to go through the courseware.

Step 2: Lerner's go through the courseware (Individually and Collaborate). Ask pupils to spend 15 minutes to discuss and share ideas on the activities with their colleagues.

Step 3: Lerner's Interact with Teacher /Instructor. Pupils then discuss the activities with the facilitator to clear all misconceptions.

Step 4: Lerner's are assessed. Give pupils exercises to ascertain their performance level.

RESULT AND DISCUSSIONS

A. *Comparison of the pre-test outcome of the control group and experimental group*

It was deduced from Table 1 that the mean of the control (2.53) group was 0.17 more than the mean of the experimental group (2.36). The spread of the other sample scores around the mean of the experimental group was 0.03 more than that of the control group. The minimum and maximum spread of the scores of both the control group and the experimental group pre-test were 1.11 to 3.95 and 0.90 to 3.82 respectively.

Table 1: Independent T-Test of Pre-test Outcome of the Control Group to Experimental Group

Group	N	Max Score	Mean ($\bar{x}$)	Std.Dev d.	t	df	P
Experimental	36	10	2.36	1.46	-0.49	70	0.62
Control	36	10	2.53	1.42			

The score of the experimental group was skewed to the left more than in the control group. The number of pupils in the experimental group who scored above 2 formed 48% which was 2% less than those who scored above 2 in the control group. The number of pupils in the experimental group who scored below 2 formed 30.6% which was 5% more than those who scored below 2 in the control group.

Table7: Frequency Distribution of Pre-test Outcome of the Control Group to Experimental Group

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	Experimental Group		Control Group	
Score	Frequency	Percent	Frequency	Percent
0	4	11.1	3	8.3
1	7	19.4	6	16.7
2	8	22.2	9	25.0
3	9	25.0	8	22.2
4	5	13.9	7	19.4
5	3	8.3	3	8.3
Total	36	100	36	100

The distribution in terms of percentage, mean and the standard deviation of the control group and experimental group shows that, pupils in the control group performed better than those of the experimental group**.** The paired t-test reveals that the performance of pupils in the control group (M=2.53, s.d=1.42) was better than the performance of the experimental group on the pretest (M=2.36, s.d= 1.46, t (70) = -0.49, p>0.05). This means that the entry level of knowledge on multiplication of fractions of the Control group was better than that of Experimental group.

B. Comparison of the Post-test Outcome of the Control Group and the Experimental group

The mean of the experimental group was 0.23 more than the mean of the control group. The spread of the other sample scores around the mean of the control group was 0.01 more than the experimental group. The minimum and maximum spread of the scores of both the experimental group and the control group pre-test were 6.18 to 9.16 and 5.90 to 8.94 respectively. The score of the control group was skewed to the left more than in the experimental group. The number of pupils in the experimental group who scored above 7 represented 52.8% of the entire number of pupils in the experimental group. This 52.8% was 5.6% more than the percentage of pupils who scored above 7 in the control group.

Although the score range of the two groups were the same, more pupils of the experimental group score higher marks than those of the control group. The performance of the experimental group in the post-test (M=7.67, s.d= 1.49), was significantly different from the performance of the control group in post-test (M=7.44, s.d=1.50, t (70) = -0.63. $p > 0.05$). The hypothesis; "there was no significant difference in the performance between those who were taught using the normal classroom teaching and learning to those who used the Multimedia Courseware to learn" was therefore rejected. This support [2] claims that courseware is an effective alternative instructional medium.

Table 8: Frequency Distribution of Post-test Outcome of the Control Group and Experimental Group

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	Control Group Post- test		Experimental Group Post- test	
Score	Frequency	Percent	Frequency	Percent
5	4	11.1	3	8.3
6	6	16.7	5	13.9
7	9	25.0	9	25.0
8	8	22.2	8	22.2
9	5	13.9	6	16.7
10	4	11.1	5	13.9
Total	36	100	36	100

Table 9: Independent T-Test of Post-test Outcome of the Control Group and Experimental Group

Group	N	Max Score	Mean	s.d	Df	t	P
Experimental	36	10	7.44	1.50	70	-0.63	0.53
Control	36	10	7.67	1.59			

The post-test shows an improvement in performance of both experimental and control groups. On the bases that the entry level of knowledge in multiplication of fractions of the control group was higher than that of the experimental group, but after the intervention the performance of the experimental group was a better than that of the control group. It confirms the assertion that the use of technology enhances and enrich the learning environment Barker (2000). The poor performance of Ghana's eight grade in TIMSS 2003 which was attributed to the less usage of technology in the classroom by [3] is justified by the outcome of this study. Teaching and learning is not only the presentation of technology or teaching and learning aid to learners, as stated by [2] that the significant role of technology in teaching and learning is limited as an instructional delivery medium and not a key determinant of learning but can enhance learning.

C. Interest in multiplication of fractions of the control group and experimental group

The initiation and sustainability of interest in a lesson is one of the key principles in the teaching and learning process. After the intervention, the researcher issued a questionnaire to both control group and the experimental group. One of the item in the questionnaire requested pupils to respond 'Yes' or 'No' to whether the lesson was interesting.
The experimental group had 13.9% more pupils than those of the control group who responded 'Yes'. The percentage of pupils who responded 'No' in the experimental group were 13.9% less the number of pupils in the control group.

There was no significant association between the control group and the experimental group in terms of development of interest in multiplication of fractions $X2$ (1) = 1.92, $p > 0.05$. Based on the odds ratio the teaching and learning in the experimental group was 1.85 times more likely to be interested than the teaching and learning process in the control group. Therefore, the hypothesis;

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"there was significant difference in the development of learner's interest in multiplication of fractions in the control group and experimental group." was rejected.

Table 10: Frequency Distribution of Pupils Interest in Multiplication of Fractions

	Control		Experimental	
Response	Frequency	Percent (%)	Frequency	Percent (%)
Yes	25	69.4	30	83.3
No	11	30.6	6	16.7
Total	36	100	36	100

From Table 10, it can be inferred that, the level of interest developed by the experimental group was higher than the control group. Although the control group found the lessons interesting, those of the experimental group found their lessons more interesting. This was due to the simulation and animation of the activities of the presentation of multiplication of fractions coupled with the ease to navigate through the courseware. Also, as pupils learnt on their own, they were stimulated by the challenging problems they encountered which made them to think [17].

Table11: Chi-Square Test of Pupils Interest in Multiplication of Fractions

	χ	Df	P
Value	1.93	1	0.13

D. *Verification of the level of satisfaction derived from the teaching and learning process of the experimental group*

During the teaching and learning process with the experimental group, the researcher verbally interacted with pupils and expressed their satisfaction by stating that:
1. They were satisfied because they had understood a mathematics topic
2. They were satisfied because they had fully participated in a mathematics lesson and opted for all other mathematics topics to be converted into an interactive multimedia courseware.

The result on Table 15 shows that, 21 of the pupils which formed 58.3% of the experimental group agreed that they were very much satisfied with the teaching and learning process. This meant that, 41.7% of the experimental group were not fully satisfied with the teaching and learning process. Out of the pupils who were not fully satisfied, 33.3% of them were not at all satisfied and the 66.6% were not very much satisfied. On the average, with the exception of the 13.9% who were not satisfied at all, 86.1% of the experimental group were satisfied with the teaching and learning process of multiplication of fraction in the experimental group. When learners are allowed to learn at their own pace with a step by step break down of the topic into manageable units and instant feedback of the courseware reduces the difficulty in learning. The collaborative learning approach used in the experimental group made learners who were reluctant to speak in large group develops the culture of speaking in large group. These accounted for the satisfaction the experimental group derived.

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Table 12: Frequency Distribution of Experimental Group's Satisfaction on the usage of Courseware as instructional medium for multiplication of Fractions

Satisfaction level	Frequency	Percent (%)
Very Much	21	58.3
Not Very Much	10	27.8
Not at All	5	13.9
Total	36	100

E. Verification of the amount of assistance required by the experimental group to use courseware to learn

Item four on the questionnaire was to find out whether pupils can use a similar courseware to learn without supervision. 52.8% of them believed that they can use the interactive courseware to learn multiplication of fractions without any support from the teacher. The percentage of the experimental group who agreed that they will need support from the teacher in other to use a similar courseware to learn was 2.7% less 50%. Out of the pupils who needed support, 35.3% of them wanted full support from the teacher and 64.7% agreed that, they will need little support to use a similar courseware to learn. With the exception of the 16.7% of the experimental group who agreed that they will need the full support of the teacher to use a similar courseware, 83.4% of the experimental group agreed that, they did not need full support.During the first two introductory lessons of the experimental group, almost every learner was calling for support. The number of pupils calling for support reduced drastically during the third and subsequent lessons. This indicated that the experimental group had gotten the concept of using the courseware to learn multiplication of fractions.

Table 13: A Frequency Distribution on Amount of Assistance Required By the Experimental Group on the Use of Courseware as Instructional Medium

Response	Frequency	Percent (%)
Full Assistance	6	16.7
Little Assistance	11	30.6
No Assistance	19	52.8
Total	36	100

CONCLUSION

Learning of the multiplication of fractions was a personal interaction by the learner with the courseware and the teacher was only a facilitator who was only call upon when the learner faces a

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challenge. [16] Stipulated that when pupils are stimulated with challenging problems it encourages them to think. It was not out of place when 83.3% of the experimental group responded 'Yes' to the question "Do you find the lesson interesting? "in the questionnaire. In the experimental group, pupils took the responsibility of completion of lessons, controlled and created their own mathematical ideas. The collaborative learning process allowed students to construct a scaffold for critical thinking and exchange information, give and receive feedback, challenge and encourage each other and jointly reflecting on progress and process [9].

The main findings of this study were the following:

1. The performance of pupils who used the Multimedia courseware as teaching and learning aid was a little above pupils who were taught with the traditional teaching and learning process, but the difference was not significant.
2. Pupils of the experimental group developed more interest in multiplication of fractions than those of the control group
3. Pupils of the experimental group confidently participated in discussions and were prepared to compare their understanding and progress with others
4. The pupils of the experimental group were satisfied with the use of courseware as an instructional delivery medium for Multiplication of Fraction.
5. Learners cannot use the Courseware without teacher support.

RECOMMENDATIONS

Based on the key findings, the researchers made three main recommendations.

1. Education policy makers should consider making it a policy that all approved textbooks companied with an interactive multimedia courseware on challenging topics in the textbook.
2. Teachers who use courseware as instructional medium should apply the collaborative method to help learners to exchange ideas, challenge other pupil's submission, and encourage each other and jointly reflecting on progress and process [9]
3. The use of an interactive multimedia courseware as the instructional medium in the classroom should not be done in isolation but with the presence of a teacher [7]

The role of the interactive multimedia courseware in the classroom is not to replace traditional educational methods, it does act as an enhancement for teaching students to think critically, communicate creatively and solve problems in analytical way especially in mathematics.

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