Enhancing Junior High School Learners' Understanding of Motherboard Components Using Powerpoint Presentations in Asante Akim South Municipal

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ABSTRACT

This study explores the impact of PowerPoint presentations on enhancing Junior High School (JHS) learners' understanding of motherboard components in Information and Communication Technology (ICT). Utilizing an action research design, the study was conducted at Wenkyi Presby Junior High School in Asante Akim South Municipal with a sample of 30 junior high school students. The intervention consisted of a structured four-week program that incorporated multimedia presentations to enhance concept retention. Data collection methods included pretests, posttests, and teacher interviews, with analysis conducted using Microsoft Excel. The pretest results revealed a low mean score of 3.5 out of 20 (17.5%), indicating significant challenges in understanding motherboard components using traditional teaching methods. Following the intervention, post-test results showed a substantial improvement, with the mean score rising to 17.5 (87.5%). The findings suggest that integrating PowerPoint presentations facilitated better knowledge acquisition by providing visual reinforcement and enhancing interactive learning experiences. Additionally, factors such as a lack of teaching materials (30%), inadequate instructional time (20%), and negative student attitudes towards ICT (20%) were identified as key barriers to effective learning. The study concludes that multimedia-based instructional strategies significantly enhance students' comprehension of complex ICT concepts. It recommends that schools invest in technology-driven teaching resources and adopt interactive pedagogical approaches to improve learning outcomes in ICT education.

Keywords: Learners; PowerPoint; Presentation; Motherboard

INTRODUCTION

Over the past decade, the integration of Information and Communication Technology (ICT) in education has transformed teaching methodologies and learning experiences. Among various ICT tools, Microsoft PowerPoint has emerged as a prevalent medium for content delivery. ICT has significantly transformed various industries worldwide. The advancements in computers, laptops, smartphones, hardware, software, the internet, search engines, and video conferencing have revolutionized the way information is created, collected, retrieved, processed, and transmitted [1]. In the field of education, particularly at the university level, the integration of ICT has shifted the traditional teacher-centered approach to a more student-focused learning model. This transformation has been facilitated through the adoption of interactive classrooms, personalized learning, collaborative engagement, and innovative teaching strategies that enhance motivation and creativity [2]. Recognizing the global shift toward technology-driven education and the need to build human capital, Ghana has made significant investments in ICT since 2008. The government has implemented strategic policies aimed at harnessing ICT for national development. One of the key interventions introduced is the "One Laptop Per Child" policy, which aims to sustain students' interest in ICT and enhance teaching and learning at the primary school level. Despite these efforts, several challenges persist, including limited access to computers, inadequate ICT infrastructure, and insufficient teacher training in technology-based instruction. Many primary schools lack the resources needed to provide comprehensive ICT education, which hinders effective learning and limits students' ability to grasp fundamental computer concepts [3]. The integration of

ICT in education has the potential to transform traditional teaching methods, making learning more effective and engaging. Research has shown that ICT deployment enhances access to educational resources, improves learning quality, fosters efficiency, and strengthens school management systems [4]. However, Ghana has yet to fully realize the benefits of ICT in education compared to developed economies that have made substantial investments in digital learning infrastructure. One critical area of concern is the comprehension of computer hardware components, particularly the motherboard, which serves as the central unit of a computer system. Despite the numerous benefits of ICT education and the frequency with which ICT is taught from upper primary to junior high school (JHS), many students in Asante Akim South Municipal continue to struggle with identifying and understanding the major components of a motherboard. This lack of comprehension can be attributed to inadequate exposure to practical, hands-on learning experiences and the limited availability of teaching aids that simplify complex concepts. The motherboard is a crucial component of a computer, housing essential elements such as the central processing unit (CPU), memory slots, and input/output ports. A solid understanding of these components is crucial for developing the computer literacy skills required for future academic and professional endeavors [5].

While previous studies on multimedia learning in ICT education have primarily focused on general improvements in student engagement and comprehension through digital tools, this study takes a more specialized approach by investigating the effectiveness of PowerPoint presentations in addressing a specific knowledge gap in students' inability to identify and understand motherboard components. Unlike prior research that has examined PowerPoint as a broad instructional aid across various subjects, this study focuses on its targeted application in teaching computer hardware concepts at the junior high school level. Additionally, whereas past research has often concentrated on university-level learners or general ICT proficiency, this study is distinct in its emphasis on younger students in Ghanaian primary and junior high schools, who may lack foundational exposure to computer hardware. By integrating PowerPoint with interactive multimedia elements, such as labeled diagrams, animations, and real-world analogies, this study aims to determine whether this approach can significantly enhance students' comprehension of motherboard components. Furthermore, while existing literature has acknowledged PowerPoint's role in enhancing visual learning, little research has been conducted on its potential to bridge gaps in technical hardware education at the junior high school level. This study addresses this gap by systematically evaluating the impact of PowerPoint-assisted instruction in a real classroom setting and assessing its effectiveness in comparison to traditional teaching methods. The purpose of this study is to investigate the factors contributing to students' inability to identify key motherboard components and explore how PowerPoint presentations can be used as an effective instructional tool to enhance their understanding of Junior High Students at Asante Akim South Municipal.

PowerPoint has been instrumental in enhancing the delivery of ICT-related content in classrooms. Studies suggest that PowerPoint-based instruction improves student engagement and comprehension [6]. By providing structured and visually appealing content, educators can explain complex ICT concepts more effectively. Integrating PowerPoint with Internet resources enhances interactive learning, particularly in business and technical education [7]. As a versatile tool in educational settings, PowerPoint facilitates the presentation of information through multimedia elements, aligning with the broader adoption of ICT to improve instructional effectiveness. Research has highlighted the positive correlation between ICT proficiency and instructional effectiveness. For example, a study by [8] assessed PowerPoint and internet skills among business education lecturers in Nigeria, demonstrating that educators with higher proficiency in these tools deliver more effective instruction. This underscores the importance of ICT competencies in contemporary education. The effectiveness of PowerPoint in enhancing student learning and engagement has been a key focus of recent research. A quasi-experimental study by [9] examined the impact of integrating PowerPoint on the motivation and academic achievement of high school students. The findings revealed that students receiving PowerPoint-assisted instruction exhibited higher motivation and improved academic performance compared to those taught through traditional methods. This suggests that PowerPoint is a valuable tool for promoting student engagement and enhancing learning outcomes. However, the design quality of PowerPoint presentations has a significant impact on their educational effectiveness. [10] provided a personal perspective on the use and misuse of PowerPoint in teaching life sciences, emphasizing that poorly designed slides can hinder learning, whereas well-structured presentations enhance comprehension. Additionally, PowerPoint plays a crucial role in

rapid e-learning, which involves the swift creation of educational content. Educators leverage PowerPoint to efficiently convert existing materials into e-learning courses, meeting the growing demand for online education. This highlights its significance in facilitating the quick development of instructional content and its value in the e-learning landscape. Developing proficiency in PowerPoint contributes to the broader enhancement of ICT skills among educators and students. A study by [11] examined students' experiences in refining their skills with presentation tools, highlighting that such competencies are crucial for effective communication and academic success. Integrating ICT tools into curricula is crucial in preparing students for the technological demands of the modern world.

MATERIALS AND METHODS

The study employed an action research design, a method commonly used to address practical classroom challenges in a systematic manner. Action research is a participatory and reflective process that enables educators to identify and address problems within their local context [12]. Given the need to investigate and improve students' poor performance in Information and Communication Technology (ICT), specifically their difficulty in identifying motherboard components, this design was deemed appropriate. Action research enabled the real-time monitoring and assessment of interventions designed to enhance students' understanding of motherboard components. The strength of action research lies in its ability to provide an orderly framework for problem-solving while enabling the researcher to observe changes in student behavior over time. Additionally, it facilitates direct engagement with participants, allowing for immediate feedback and adjustments (13). The population for this study consisted of students and teachers from Wenkyi Presby Junior High School (JHS) in Asante Akim South Municipal. A total of 93 students participated, consisting of 53 females and 40 males. A purposive sampling technique was employed for this study. This approach was chosen because the problem of poor ICT performance, particularly in identifying motherboard components, was most evident among JHS 1 students. The sample consisted of 30 JHS students, comprising 14 boys and 16 girls. Additionally, ten teachers from neighboring schools were selected for interviews to provide further insights into the issue. A structured test was used as the primary data collection tool, as it enabled the researcher to obtain quantitative data that could be rigorously analyzed. Tests are valuable in educational research due to their ability to measure knowledge acquisition and comprehension objectively (14). Interviews were conducted with selected teachers at their preferred locations and times.

Intervention

The intervention process was structured into three stages: Pre-Intervention, Intervention Implementation, and Challenges faced. The intervention phase spanned four weeks. Prior to implementation, permission was obtained from the head teacher and the class teachers of JHS. A projector was borrowed from a nearby school to facilitate the intervention, and a PowerPoint presentation containing visuals of motherboard components was prepared.

Intervention Implementation

Week 1: A pretest was administered to JHS 1 students within 30 minutes to establish baseline knowledge. The test consisted of items scored out of 20 marks, providing the first dataset for analysis.

Week 2: The projector was set up in the classroom, and an introductory lesson was delivered on the system unit and its main functions.

Week 3: Students were introduced to the motherboard, with visuals projected to highlight its main components. Key parts of the motherboard were zoomed in to enhance visibility. Students were encouraged to ask questions and engage with the lesson.

Week 4: A posttest was administered under similar conditions as the pretest, with a duration of 30 minutes and a total score of 20 marks. The results formed the second dataset for the study.

Data Analysis

Data obtained from the pretest and posttest were analyzed using Microsoft Excel. Frequency distribution tables and mean scores were used to compare the results of the pretest and posttest**.**

The results and discussion section connect the findings to the broader educational theory of Mayer's Cognitive Theory of Multimedia learning

RESULTS AND DISCUSSION

This section presents the results of the data analysis and discusses the study's findings. The discussion provides answers to the research questions. It examines the impact of PowerPoint presentations on pupils' understanding of motherboard components, as well as the factors affecting their ability to identify these components.

Effect of PowerPoint Presentation on Pupils' Understanding of Motherboard Components

To determine whether the use of PowerPoint presentations enhances pupils' understanding of the motherboard components, a pre-test and a post-test were conducted.

Pre-Test Results

The pre-test results indicate a generally low level of understanding of motherboard components among pupils before the intervention. The mean score of 3.5 out of 20 (or 17.5%) is significantly below the expected performance threshold, suggesting that pupils had considerable difficulty in recognizing and understanding the functions of motherboard components. The fact that no student scored above 8 marks and that 15 out of 30 pupils (50%) scored only 2 marks underscores the challenges faced in grasping the topic through conventional teaching methods. A key observation from these results is the wide gap between the highest and lowest scores, reflecting varying levels of prior exposure and comprehension among pupils. The distribution of scores suggests that the traditional teaching methods employed before the intervention were not sufficiently effective in conveying the necessary knowledge. This aligns with findings by [15], who emphasize that text-heavy and lecture-based approaches to teaching technology-related subjects often lead to poor retention and understanding among students. The lack of students achieving at least half of the total marks (10 out of 20) further suggests that the initial instructional approach might have been inadequate in engaging learners or facilitating deep comprehension. This reinforces the need to adopt more interactive and visually appealing teaching methods, such as multimedia presentations, to enhance student engagement and information retention.

Table 1: Pre-Test on Pupils Understanding of Motherboard Components

Marks (x)	**Number of Pupils (f)**	**F(x)**
2	15	30
4	9	36
6	4	24
8	2	16
10	0	0
12	0	0
14	0	0
16	0	0
18	0	0
20	0	0
Total	**30**	**106**

The mean score: 106/30 = 3.5

Post-Test Results

Following the implementation of PowerPoint presentations as an instructional tool, the post-test results reveal a dramatic improvement in pupils' understanding of motherboard components. The mean score increased to 17.5 (or 87.5%), demonstrating a significant rise in performance. Unlike the pre-test, where no student achieved at least half of the total score, all students in the post-test scored above 12 marks, with 10 students (33.3%) achieving a perfect score of 20 marks. This notable improvement can be attributed to the multimedia approach facilitated by PowerPoint presentations. The pupils' ability to recall and apply knowledge more effectively after the intervention highlights the effectiveness of the PowerPoint-assisted teaching methodology. Furthermore, the shift in score distribution suggests that PowerPoint presentations helped bridge the comprehension gap among students. In contrast to the pre-test results, where a large portion of students scored at the lower end of the spectrum, the post-test results indicate that all pupils improved their performance levels. The increased motivation and engagement provided by the multimedia approach likely played a crucial role in pupils' improved scores.

Table 2 presents the scores obtained after using PowerPoint presentations as an instructional tool.

Marks (x)	Number of Pupils (f)	F(x)
2	0	0
4	0	0
6	0	0
8	0	0
10	0	0
12	2	24
14	6	84
16	4	64
18	8	144
20	10	200
Total	**30**	**516**

The mean score 516/30 =17.5

Factors Affecting Pupils' Ability to Identify Major Motherboard Components

The investigation into the factors contributing to pupils' difficulties in identifying motherboard components revealed several critical insights. A major factor, as highlighted by 30% of teachers, is the lack of teaching and learning materials. This observation is consistent with the work [33] that emphasizes the role of resources in enhancing ICT education. Without proper instructional materials, students struggle to develop a solid understanding of motherboard components, resulting in poor performance. Additionally, the study found that inadequate instructional time (20%) and students' general dislike for ICT (20%) also contributed to the challenges in learning motherboard components. This finding is supported by [16], who states that student attitudes toward a subject significantly influence their learning outcomes. The perception of ICT as a difficult subject by some students (20%) further exacerbates the challenge, as negative attitudes often lead to disengagement and reduced effort in learning activities. Furthermore, 10% of teachers attributed the difficulty to poor teaching techniques. This suggests that, in addition to adopting multimedia tools such as PowerPoint presentations, it is essential to improve pedagogical approaches. Implementing more interactive and student-centered teaching methods could further enhance pupils' comprehension and interest in ICT.

Factors	No. of Respondents	Percentage (%)
Lack of teaching/learning materials	3	30
Poor teaching techniques	1	10
Inadequate time for ICT lessons	2	20
Pupils' general dislike for ICT	2	20
ICT perceived as a difficult subject	2	20
Total	**10**	**100**

DISCUSSIONS OF THE RESULTS

The results align with Mayer's Cognitive Theory of Multimedia Learning (CTML), which posits that learning is more effective when instructional materials integrate both visual and auditory channels to facilitate cognitive processing. [17] emphasizes that multimedia learning enhances knowledge retention by engaging learners in dual-channel processing, where words and images are processed simultaneously rather than overloading a single cognitive pathway.

The poor performance observed in the pre-test reflects the challenges associated with traditional lecture-based teaching methods, which rely primarily on verbal instruction and text-heavy content. According to Mayer's cognitive load theory, excessive reliance on verbal explanations can lead to overload in the auditory channel, limiting the learner's ability to retain and process information. The results support this theory, as students demonstrated difficulty in identifying motherboard components when taught through conventional methods. The significant improvement in post-test results, with a mean score increase from 3.5 to 17.5, strongly validates Mayer's multimedia effect, the idea that combining words, images, and animations reduces extraneous cognitive load, thereby allowing learners to construct more effective mental models of complex concepts. The PowerPoint presentations used in this study leveraged Mayer's principles of using both spoken words and images to enhance learning more effectively than relying on text alone; avoiding redundant on-screen text while using explanatory visuals helped maintain cognitive balance, and placing motherboard component labels close to corresponding images improved retention and understanding. These principles explain why students performed significantly better in identifying and understanding motherboard components after the multimedia intervention.

However, the shift in score distribution from 50% of students scoring only 2 marks in the pre-test to 33.3% achieving a perfect score of 20 marks in the post-test demonstrates how multimedia-based instruction enhances engagement and minimizes comprehension disparities. This aligns with Mayer's assertion that multimedia fosters meaningful learning by presenting content in an integrated, learner-friendly manner.

CONCLUSION AND RECOMMENDATION

This study highlights the critical role of multimedia learning in ICT education, particularly in improving pupils' understanding of motherboard components. The significant improvement in post-test scores following the use of PowerPoint presentations demonstrates the effectiveness of multimedia tools in enhancing comprehension and retention. The findings also reveal key challenges affecting ICT education, including inadequate teaching resources (30%), ineffective teaching methods (10%), limited instructional time, and negative student attitudes toward the subject. To address these challenges, it is essential for ICT educators to adopt multimedia strategies aligned with Mayer's Cognitive Theory of Multimedia Learning. Integrating animations, diagrams, and interactive PowerPoint slides can enhance engagement, correct misconceptions, and improve long-term retention of ICT concepts.

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