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Exploring the Potency of Culturally Relevant Pedagogy in Improving Students' Cognitive Proficiency in Computer Studies

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ABSTRACT

This study investigates the efficacy of integrating culturally relevant pedagogy (CRP) into computer studies curriculum to enhance students' cognitive proficiency. Recognizing the importance of cultural context in education, this study delves into the potential of CRP to address disparities in academic achievement and engagement among senior secondary students. A total of 139 students of which 72 were in the experimental group and 67 students in the control group. Each group was an intact class. The study employed an explanatory sequential design (quasi-experimental and interviews). The data gathered to examine the impact of CRP implementation on students' cognitive development for the quasi-experimental phase were obtained through the Achievement Test in Flowchart and Algorithm (ATFA) which had a reliability coefficient of 0.83. The experimental group was taught using indigenous knowledge approach (IK), while the control group was taught using the lecture method. The result obtained showed that the experimental group outperformed the (mean for experimental = 23.89; control 17.99; [F(1,136)=4.44; p<.05] control group. Difference in gender-based performance in the experiment group also attained a statistical significance. The results of this study underscore the significance of culturally responsive approaches in improving learning outcomes and advancing inclusive pedagogical practices in the field of computer studies.

Keywords: Computer Studies; Culturally relevant pedagogy, Indigenous knowledge; Flowchart; Algorithms

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1. INTRODUCTION

In a world where technological advancement is accelerating at an unprecedented pace, the ability to navigate the digital landscape is no longer just a skill but a necessity for thriving in the 21st century.

Yet, the traditional approach to teaching computer studies often falls short of engaging and empowering students, particularly in Africa where cultural relevance holds immense significance. In the pursuit of educational excellence, the significance of culturally relevant pedagogy (CRP) cannot be overstated. As Ardianti and Raida (2022) highlight, science education serves as a cornerstone for national development, emphasizing the critical role of aligning educational practices with local contexts. Ardianti and Raida (2022) emphasize that science education is vital for national development and that educational practices should be aligned with local contexts.

Additionally, integrating Indigenous Knowledge Systems (IKS) into teaching methods has gained attention as a way to improve learning outcomes in diverse educational settings. Lazarus (2019) highlights the potential of Indigenous Knowledge (IK) in simplifying complex concepts and enhancing the learning experience, particularly in rural communities.

Although the potential of Cultural Responsive Pedagogy (CRP) and the incorporation of indigenous knowledge into educational practices are recognized, there is still a significant gap in the literature regarding its application in computer studies, especially in secondary schools (Oladejo & Geleyi, 2016). While efforts have been made to utilize indigenous knowledge in teaching computer science concepts (Agbanimu, 2020), there is a lack of comprehensive research addressing the specific challenges and opportunities in this intersection.

For instance, consider a secondary school in Nigeria where students are introduced to computer programming languages using standard textbooks and methods imported from Western educational models. Despite the enthusiasm for learning, many students struggle to grasp the abstract concepts presented in these materials, finding them disconnected from their everyday experiences and cultural contexts. This illustrates the gap between traditional computer studies education and students' cultural backgrounds, underscoring the need for research that explores how culturally relevant pedagogy can be effectively integrated into computer studies curricula. The problem at hand is the disheartening state of students' performance towards learning Computer Studies in secondary schools. Despite the importance of computer literacy in modern society, students' academic achievement in Computer Studies has been below average, as evidenced by internal and external examination reports (Chief examiner's report, 2013-2018). While existing research focuses primarily on academic achievement, there is a lack of understanding regarding how to effectively teach and reinforce complex concepts in Computer Studies, thereby leaving a gap in the literature.

Imagine students exploring algorithms through the lens of traditional storytelling, or dissecting programming languages alongside indigenous linguistic structures. This integration of indigenous knowledge not only enhances comprehension but also cultivates a sense of ownership and empowerment among learners. The rapid evolution of technology has made computer literacy an essential aspect of everyday life. However, traditional teaching methods may not effectively engage students or facilitate long-term retention of complex concepts (Takada et al., 2020). Factors such as the mode and manner of teaching, learning environments, and students' characteristics can all impact learning outcomes (Okebukola, 2020). Therefore, there is a need to explore innovative teaching strategies that leverage Indigenous Knowledge Systems (IKS) to improve students' understanding and retention of computer science concepts.

1.1 Ausubel's Subsumption Theory

In Ausubel's subsumption theory learning occurs when information learned is subsumed into the learners' cognitive structure in hierarchical order and by implication, the learners' prior knowledge serves as the basis for the the meaningful understanding of new information. What the learner already knows is the most important factor that influences meaningful learning. His theory believes that meaningful learning occurs when learners can consciously and explicitly link new knowledge to relevant concepts, they already have knowledge about. This study relates with Ausubel's theory in a way that the use of indigenous knowledge to teach the experimental group to enhance the student's understanding of the concepts being taught since those concepts were linked to their prior cultural knowledge. The use of these culturally and contextually relevant illustrations will foster meaningful learning of concepts in computer studies and hence improve students' performance.

1.2 Culturally Relevant Pedagogy and Computer Studies

The domain of computer studies has traditionally been seen as a discipline divorced from indigenous pedagogical methods. However, recent research and innovative practices challenge this notion, suggesting that indigenous knowledge and cultural frameworks can effectively enrich the teaching of computer science. Despite prevailing perspectives that view computers solely through a lens of logic and mathematics, disconnected from cultural contexts, there exists untapped potential in integrating indigenous perspectives into computing education.

Technological advancements over the past decade have facilitated the adaptability of computers to diverse cultural landscapes. Machine learning algorithms and natural language processing techniques now enable computers to engage with indigenous languages with remarkable accuracy and sensitivity. This technological confidence fosters a shift towards high-quality teaching and learning methodologies, emphasizing active learning and tailored content delivery (Latorre-Cosculluela et al., 2021).

By leveraging Information and Communication Technology (ICT), educators can cater to individual learning styles, particularly in the abstraction-heavy domains of computer studies, mathematics, and science (Oladejo et al., 2023). ICT tools not only offer immediate feedback to students, helping prevent misconceptions, but also provide avenues for practical application of acquired knowledge (Al-Rahmi et al., 2022).

Beyond cognitive development, ICT integration in STEM education has been shown to enhance affective learning outcomes, fostering increased motivation among students (Turk & Akyuz, 2016). However, challenges persist, particularly in African secondary schools, where factors such as inadequate resources, lack of qualified teachers, and ineffective teaching strategies hinder student comprehension and performance (Agbanimu et al., 2022; Gbeleyi et al., 2022).

Addressing these challenges requires a paradigm shift towards culturally relevant pedagogy. Evidence suggests that incorporating students' cultural activities and experiences into the learning process promotes innovative thinking and enhances academic achievement (Ademola et al., 2022; Onowugbeda et al., 2022; Ladson-Billings, 2023). Culturally relevant teaching not only scaffolds learning but also cultivates students' sense of cultural identity and self-awareness (Mawere, 2015).

In the realm of computer studies, culturally relevant approaches have shown promise in tackling complex concepts. Studies have demonstrated that incorporating indigenous knowledge systems into teaching, such as the Culturo-Techno-Contextual approach, enhances students' understanding and performance in areas like flowcharts and algorithms (Agbanimu et al., 2022; Gbeleyi, et al., 2022). By contextualizing learning materials within students' cultural frameworks, educators can create more engaging and effective learning environments, bridging the gap between traditional knowledge systems and modern computational science.

1.3 Research Questions

The following research questions guided this study

1. Is there a statistically significant difference in the achievement score of senior secondary school students in computer studies between Indigenous knowledge and traditional lecture methods?
2. Is there a statistically significant difference in the achievement scores of male and female students taught using the Indigenous method?

1.4 Indigenous Knowledge System

Indigenous knowledge has been defined and conceptualized in various ways by different scholars (Mawere 2015, Shizha 2013, Jophus 2020) to distinguish it from knowledge, understanding, and ideas developed through colonization. One of the earliest definitions of IKS was developed by Warren (1996), who referred to it as a systematic body of traditional knowledge acquired by people in their local environment through accumulated experiences, informal experiments carried out consciously and unconsciously, and intimate interaction between people and their environment. Mawere (2015) argued that Warren's definition has presumed IKS to be static by referring to it as traditional knowledge. However, Smith (2021) also argued that being "traditional" does not necessarily mean being old and unchanging. Traditions often appear recent and are frequently dynamic, giving rise to new traditions from the old ones.

Indigenous knowledge is a complete knowledge system with its own concepts of epistemology and its own scientific and logical validity (Magni, 2016 and Lazarus, 2019). Indigenous knowledge represents generations of creative thoughts and actions within each individual community. As a result of this, it struggles with an ever-changing set of conditions and problems. This strong contextual and cultural connection has made indigenous knowledge to become an essential part of rural people's lifestyle as it provides the necessary means of survival.

With the understanding of the concept of IKS, series of studies have been conducted to examine the impacts of IK system in promoting meaningful science education in Africa. One of such study is carried out by (Fafunwa, 2018). He found that adequate knowledge of the traditional or indigenous educational system which existed before the arrival of Islam and Christianity is required for meaningful understanding of science in Africa. Unlike the Islamic and christain education which arrived later in the 14th and 19th century respectively, indigenous education existed far back and persists even today, showing no signs of disappearing from the educational scene.

This indigenous knowledge can be conceptualised as the African modern scientific knowledge (Asheena, Busisiwe and Godson, 2017). Other Studies that have explored the use IK to the teaching and learning of science include Anor et al., (2022); Brits, de Beer, & Mabotja, (2016); Pascal (2020); Ogar & Mustonen, (2020). While Anor et al., (2022); examine the effectiveness IK on a purely science subject; chemistry and found a significant difference in the students' achievement, Brits, de Beer, & Mabotja, (2016) incorporates arts into its study in the form of play and storytelling, but also found similar result as Anor et al., (2022); These outcomes only prove the efficacy of IK in the African education system and not only in science.

Recognizing the significance of indigenous knowledge systems in education, there are several challenges that need to be addressed. These include limited resources, insufficient training for educators, and the need for more research and documentation. However, collaboration between indigenous communities, researchers, and educational institutions can help overcome these challenges, ensuring the successful integration of indigenous knowledge into educational practices. It is worth noting that a promising approach called the culturo-techno-contextual approach (CTCA) has been developed and is currently being integrated into the teaching and learning of STEM courses in Nigeria and Ghana.

CTCA is an innovative approach to teaching and learning in science and other fields of knowledge. It aims to break down traditional barriers that hinder meaningful learning, such as fear of science due to its complex language and mathematical orientation, lack of facilities for teaching and learning, abstract nature of some concepts, and the belief that science is only for geniuses. CTCA draws on the power of three frameworks - cultural context, technology mediation, and locational context - to make science education more accessible and engaging for all learners. The cultural context takes into account the cultural background of all learners, while technology mediation refers to the use of technology in teaching and learning. Finally, the locational context recognizes the unique identity of every school and uses local case studies and examples to make science lessons more relevant to learners. Overall, CTCA is a holistic approach to science education that seeks to create a more inclusive and effective learning environment for all.

Several empirical studies in Nigeria, including those conducted by Oladejo et al. in 2022 and 2023, Onowugbeda et al. in 2022, and Ademola et al. in 2023, have shown that students grasp difficult concepts more effectively when those concepts are related to their cultural knowledge, and examples used to illustrate the concepts are drawn from their immediate learning environment. This teaching approach has had positive impacts on learning and has been shown to enhance students' achievement and attitude towards STEM subjects. This study focuses on the role of indigenous knowledge in improving students' achievement and attitude towards learning computer studies, as there is evidence of students' underperformance in this subject. The next section will discuss students' performance in computer studies.

2. METHODOLOGY

2.1 Design of the study

This study adopted mixed methods design. The quantitative phase of the study employed a quasi-experimental pretest-posttest nonequivalent group design. The strength of this design is that it allowed us to use findings from the qualitative phase to provide an in-depth explanation of the results obtained from quantitative data.

2.2 Participants and Study Context

We purposively selected two public senior secondary schools within the same educational district for this study (Lagos State Education District V). Senior secondary II students were considered appropriate for this study because they have learnt computer studies for at least one session. One school served as the experimental group and the other school served as the control group. We ensured that the schools that participated had computer studies teachers and a record that the students offer the subject in the previous session. The schools were considerably distanced from one another to avoid undue interaction among participants, which may have confounded the outcome of the study. A total of 139 students of which 72 were in the experimental group and 67 students in the control group. Each group was an intact class.

2.3 Procedure for data collection

The data for the quasi-experimental phase were obtained through the Achievement Test in Flowchart and Algorithm (ATFA). ATFA is a multiple-choice test instrument containing 40 questions. The items were constructed following the 20 golden rules established by Okebukola (2015) and are in line with the WASSCE standard, where each option is attached to the questions.

The team of experts comprises three computer studies teachers with over five years of teaching experience and have been involved in coordination exercises of WAEC SSCE and NECO SSCE script marking. The questions were evenly distributed across the cognitive process dimension (Anderson and Krathwohl 2001) and each question carried equal score weight. The instruments were validated, and their reliability were established using test-retest, split-half, and Cronbach's alpha (SPSS version 23 was used), as applicable, and a reliability coefficient of 0.83 was obtained. The instrument was used to test the prior knowledge of the students before the treatment (pretest), the knowledge gained after the treatment (posttest).

To strengthen the argument of the result and not base the discussion of the findings on our conjecture, we allowed the students to express their conceptual understanding as well as their perception of the new learning method. The students were selected based on their attendance and active participation in the learning activities throughout the lesson periods. Also, because we are interested in finding gender equality/difference in the student's performance, the selection was based on mixed sex, ensuring an equal number of females to males. The interviews were conducted the day after the posttest in a relatively noise-free area of the school to avoid distractions and to make the students feel relaxed and comfortable. While securing their confidence and cooperation, each of the students was informed that the interview was not a test and thus, there were no right or wrong answers.

They were also informed that the session was being recorded, while some salient points made by the students were noted, particularly, those expressed through gestures and non-verbal cues such as shaking of the head. Each session lasted about 15 minutes.

2.3 Treatment

Following the pretest, the experimental and comparison groups were taught and learned for four weeks. To control for the bias in teaching effect, we allowed each group's teachers to teach the concept for 80 minutes per week. The teacher of the experimental classes, however, received training on how to incorporate Indigenous knowledge into the classroom before the teaching exercise, and we used three micro-teaching sessions to evaluate their mastery of the process. The comparison class had no special treatment other than the traditional lecture method which is often done with the chalk-and-talk method of lesson delivery. This method allows the teacher to be the main authority figure. We noted that the knowledge gained depends largely on what the teacher says or does, as the opinions of the learners count very little.

2.4 Procedure for Data Analysis

To answer the first and second research questions, we applied a one-way analysis of covariance (ANCOVA) to the students' pretest and post-test scores using IBM SPSS version 23. To justify the use of this statistical tool, two preliminary tests of parametric assumptions were conducted on the data, and the results obtained (see tables 1 and 2) showed that the data satisfied the assumptions of homogeneity of variances, with the Levene's test result not significant ($F = 1.30$; $p > .05$) implying no significant difference between the groups, hence, comparable. The Shapiro–Wilk's test (as the Kolmogorov-Smirnov's test) of normality showed that the population from which the two groups were drawn is not significantly different from normal. The lecture method group: [(67)=.98; p>.05] and the indigenous knowledge group: [(72) =.98; p>.05]. Since randomization was not achieved, the pre-test scores were used as the covariate to draw the two groups to the same base.

3. RESULTS

Having met the parametric assumptions, we proceeded with the analyses using one-way ANCOVA for research question one. The result of the descriptive analysis (see Table 1) showed that students in the experimental group had a higher mean score (23.89) than their counterparts in the comparison group (17.99). However, to ascertain whether the observed difference can be considered statistically significant and not due to error variance, the obtained result was subjected to inferential testing, and the obtained result is shown in Table 2. The result in Table 2 shows that the observed difference in the mean scores of the control and experimental groups is statistically significant. Thus, the experimental group performed significantly better than the comparison group [$F(1,136)=4.44$; $p<.05$].

On the second research question, the result of the descriptive analysis revealed that the males had a slightly lower mean score (22.97) than the female students (24.67). A closer look at the pretest achievement row in Table 3 shows that at entry, the male and female students in the experimental group were significantly different from one another on the measure of achievement in the flowchart and algorithm. However, after treatment, the inferential statistic (one-way analysis of covariance) applied to the obtained data shows that the observed difference in the mean scores of the CTCA female and male students no longer attains statistical significance [$F(1,63) =.75$; $p>.05$].

Table 1: Mean and Standard Deviation for the control and experimental group

Dependent Variable: Achievement Posttest

Method	Mean	Std. Deviation	N
Use of Indigenous knowledge	23.89	4.164	72
Lecture method	17.99	4.971	67
Total	21.04	5.432	139

Table 2: ANCOVA summary table of difference in achievement of control and experimental groups

Tests of Between-Subjects Effects

Dependent Variable: Achievement Post

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Achievement Pretest	1078.21	1	1078.21	82.20	.00
Method	58.18	1	58.18	4.44	.04
Error	1783.89	136	13.12		

Table 3: Mean and standard deviation for male and female students in the experimental group

Descriptive Statistics

Dependent Variable: Achievement Post

Sex	Mean	Std. Deviation	N
Male	22.97	3.95	33
Female	24.67	4.23	39
Total	23.89	4.16	72

Table 4: ANCOVA summary table of difference in achievement of male and female students in the experimental group

Tests of Between-Subjects Effects

Dependent Variable: Achievement Post

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Achievement Pretest	294.47	1	294.47	22.95	.00
Gender	9.64	1	9.64	.75	.39
Error	885.17	69	12.83		

4. DISCUSSION OF RESULTS

The focus of this study was to explore the potency of Culturally Relevant pedagogy in improving students' cognitive proficiency in computer studies. We approached solving the identified problem through an empirical investigation, and we were guided by the two questions raised in the introductory part of this report.

The first research question in this study sought a statistical difference in the achievement score of senior secondary school students in computer studies taught between Indigenous knowledge and traditional lecture methods. As shown in Tables 1 and 2, we found that students in the experimental group (taught with the indigenous method) performed better than the control group (taught with the lecture method). This finding suggests that indigenous knowledge-based teaching has a substantial effect on students' overall academic achievement compared to the conventional lecture method. This finding is consistent with previous research that highlights the importance of integrating culturally relevant pedagogical approaches in education.

Studies by Owusu-Agyeman and Serwaa (2020) have shown that indigenous knowledge may hold valuable insights and foster a deeper understanding of subjects among students. The univariate Fs on achievement further support the superior impact of indigenous knowledge-based teaching, indicating that students taught through this approach outperformed their counterparts taught through the conventional lecture method. The higher mean score obtained by students taught through indigenous knowledge-based teaching may be attributed to the cultural relevance and context-specific nature of the teaching method. Previous research by Hornby and Lafaele (2011) have emphasized the importance of acknowledging and preserving cultural heritage in education to enhance students' engagement and learning outcomes.

The inclusion of indigenous knowledge in the learning process offers culturally relevant and context-specific perspectives, making the educational experience more meaningful and engaging. By incorporating local wisdom and practices, students are better able to relate to the subject matter, fostering deeper understanding and interest. This statement is in line with two of the responses received from interviewees:

> ***Moses (pseudo name – male)*** *said -Alright thank you very much, I think I enjoyed the lesson, it was an interesting lesson for me compared to the lesson we have been having so far, for the lesson I remembered the aunty that taught mentioned that the method used is indigenous knowledge system and practices, it's a new method for me and I did enjoy it because it included certain things that we do in our locality and I must say I enjoyed the class, I enjoy the class and I love it.*
> ***Lateefat (pseudo name – male)*** *...for me, it helps me to... To understand the lesson from a... Traditional background sort of because some of these things that I was told during the inquiry from my parents and other people around, I noticed they were some things that I already knew but I never related it to flowchart and algorithm; and when I inquired from them they taught me lessons that I cannot forget now I know that even some of these things we learn in school have some roots from the things we already know or have in our locality and it's part of the thing i enjoyed the most in this lesson flowchart and algorithm.*

The conventional lecture method may not fully capture the cultural nuances and context-specific elements necessary for comprehensive learning. Traditional lectures are often characterized by one-way communication, limiting students' active participation and engagement. As a result, students may have comparatively lower academic achievement due to reduced interest and comprehension (Hornby and Lafaele, 2011).

The significance of integrating the indigenous knowledge system into education becomes apparent when considering the broader implications for the learning environment. Educators should recognize the value of cultural diversity and tap into the wealth of knowledge that indigenous communities offer. By doing so, educators can create inclusive and culturally responsive classrooms, promoting a sense of pride and identity among students.

This aligns with the global movement toward culturally relevant pedagogy, emphasizing the importance of recognizing and valuing diverse cultural backgrounds in education (Owusu-Agyeman and Serwaa, 2020). Research question two, sought to examine if there would be a statistically significant difference in the achievement of male and female students taught Flowcharts and Algorithm using indigenous knowledge systems. We found a non-significant difference in the post-test achievement of male and female students in the experimental group, as seen in Tables 3 and 4.

The findings of this study show consistency with Ada (2019) who found no statistically significant difference in the academic achievement of male and female students in biology. The findings were generated from a sample of 280 senior secondary school students (SS2) male and female students offering biology in Calabar municipality. The findings are also in line with a study conducted by Jamilu, Chado, and Shittu (2020) on chemistry, with a sample size of 200 students (66 males and 134 females), they found no statistically significant difference in the performance of males and female students in chemistry.

The findings of this study disagree strongly with Osadebe and Ogbomena (2018) whose study to access the demographic influence on students' performance in mathematics using a sample of 759 students (male and female) in Delta State, Nigeria, and their findings showed that there was a statistically significant difference between gender and student’s performance in mathematics.

The study is in line with various studies like Oludipe (2012) which have all observed that gender differences do not affect student performance. Other studies argue vehemently with the fact gender differences have a role to play in student's performances and their findings are in favor of male students, studies which include Musa and Samuel (2019); Igoegwu and Okonkwo (2012) are also firmly in line with the fact that the male students perform better. The position of these researchers was based on various societal beliefs. The issue of gender differences seems like a fallacy because this study firmly disagrees by proving that gender differences do not affect student's performances.

However, since the female students outperformed their male counterparts with slightly higher mean scores, the results of this were possibly due to the following factors; female students are more inclined to the teaching method of the indigenous knowledge system than their male counterparts.

Female students often are shouldered with the responsibility of household management and house chores, so are they more opportune to the knowledgeable elders at home, thereby exposing them to indigenous materials like folklore, cultural beliefs, and traditions. Female students are far more inquisitive about their immediate environment, nature, and how various indigenous practices are carried out. Therefore, Females are more inclined to indigenous knowledge than their male counterparts. This does not by any means dispute the findings of the study which debunks gender differences as influencing performance, instead it further shows that indigenous knowledge can be used in classrooms because it does not give room for gender disparities, disregard, or discrimination.

The effect size of gender differences as shown is the findings which shows a partial eta squared of .011 this shows a very small effect size and indicates that gender has little or no effect on the achievements of students taught using indigenous knowledge system. Other studies like Dansu (2021) which investigated the impact of indigenous knowledge teaching approach on learning outcomes (comprehension and entrepreneurial skill) of chemistry students, i) the relative effectiveness of IKS and conventional method on learning outcomes of the students, in which 182 students took the study.

Research hypotheses were tested using Kruskal walls test. The results obtained showed: that the experimental group (students taught using indigenous knowledge system) performed better than the control group. ii) There was no difference between the performance of male and female students in the experimental group.

The study also tentatively concluded that teaching students using IKS approach enhances knowledge, comprehension and should be adopted by teachers in teaching concepts of chemistry and other science subjects. This establishes the fact that IKS used as a teaching approach cannot be influenced by gender differences, it does not support gender bias, degrades any gender and if taught properly in classrooms by a knowledgeable teacher, it can be used as an effective teaching tool to yield better performances of male and female students alike.

5. CONCLUSION

This study set out to address the long-term issue of secondary school students' inadequate performance in computer studies and other subjects that they considered to be challenging. Therefore, to overcome the conventional obstacles to meaningful learning of flowcharts and algorithms, we investigated the effectiveness of Indigenous knowledge systems as a culturally relevant pedagogy. The indigenous knowledge system, which major components are the cultural practices, folktales, folklores, local wisdom and cultural beliefs. The incorporation of learners' cultural backgrounds and experiences into teaching and learning process helps to scaffold learning. The use of the mother tongue has also proved to be helpful in engaging learners' interest, teaching becomes more learners centered as learners can relate and construct knowledge.

This further encourages collaboration between learners as various intercultural beliefs, superstitions and cultural practices can be exchanged between learners, thus becoming familiar with various cultural backgrounds. This awakens the preservation of the cultural heritage as students slowly become acquainted with indigenous practices and can relate the information further into various subject areas apart from the sciences.

A major key conclusion derived was that gender differences do not affect using IKS as a teaching method for students, while there could be various factors causing one gender to vary in interest than the other, it does not give room for gender disparities. On the other hand, the mobile learning system might affect gender while it is dangerous to make generalizations, it is important to note that various factors may be responsible for these and equally important to note that students' performance is still very much subjective to individual differences.

6. LIMITATIONS AND FUTURE DIRECTION

While the findings of this study may be considered a useful contribution to the body of knowledge in computer science education, it is important to acknowledge that the scope and sample size of this study represent the limitations of generalizing the results of the study. We also acknowledge that the content of the study only focuses on flowcharts and algorithms. We suggest that for future studies, other researchers may focus on the affective domain rather than just the cognitive domain; proficiency should be studied with a larger sample size and a longer intervention period.

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