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FACTORS INFLUENCING STUDENT'S PERCEPTION IN COMPUTER PROGRAMMING

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Abstract

This study examines the factors influencing students' perception of computer programming. Specific objectives of the study are to examine the psychological, social, physiological, method of instruction and environmental factors that influence students' perception to computer programming and determine the relationships that exist between the factors. The study population consists of 524 HND2 students of Computer Science Department and sample size of the study was 227. The study used descriptive and experimental research design using SPSS version 22 for data analysis. The findings revealed that psychological factors, environmental factors, physiological factors and methodology of instructions have significant influence on students' perception to computer programming while social factors have no significant influence on students' perception to computer programming. A correlation analysis showed that psychological factors, physiological factors, environmental factors and method of instruction significantly influence students' perception to computer programming and social factors had no significant influence on students' perception to computer programming. The results from the experiment class revealed that though majority of the class viewed computer programming as difficult and complex, an approach that teaches problem solving, creative and logical reasoning skills required to write computer programs will ease the complexity of computer programming and also build the students' confidence while learning computer programming courses.

Keywords: Computer Programming, student's perception, method of instruction, experimental research, correlation analysis

Introduction/Background of Study

Computer programming is one of the skills required by most students majoring in computer science and other technology related courses. The art of programming includes knowledge of programming tools and languages, problem-solving skills, and effective strategies for program design and implementation. Learning programming skills is considered by many novice programmers as a difficult process[1].Computer programming is a cognitive process and opined that difficulties involved in teaching programming as an introductory course arise from the cognitive process complexity that is necessary for developing this ability[2][3]. Introductory programming courses have a relatively high failure rate and programming is considered the most difficult and least interesting subject by most first year students in all computing courses[1]. One reason computer programming instructions seldom results in the successful transfer of problem-solving skills lies in a lack of understanding of good instructional approaches in this direction[3]. A common approach in programming education is to first teach the basics of a programming language and then guide students towards effective strategies for the whole programming process but literature shows that students still struggle to learn computer programming [4]. Students have difficulties learning computer programming as contained in literature but lack of problem solving and design skills and

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other environmental factors are major causes of this difficulty[1]. This suggests that students' difficulties may have more to do with the nature of programming than with teaching method adopted. The art of programming includes knowledge of programming tools and languages, problem-solving skills, and effective strategies for program design and implementation. Teaching computer science in higher institution is clearly enlisted to school's pedagogical paradigm for constructivist learning approach where students are encouraged to enrich what they learn from the tutor with previously acquired knowledge in order to formulate new ideas or concepts. This is a form of algorithmic thinking. Computational thinking theory advocates that algorithmic thinking is a fundamental skill which everyone can realize [5]. Combining this educational procedure with Piaget's model for cognitive learning, where students are taught something, they think about it and then try to express it in their own words, could be applied to teach students computer programming courses[6]. The authors observed that students often perform poorly in computer programming courses because of the general notion that programming is a complex task and the incorrect perceptions that sound knowledge of mathematics is a requirement for being a good programmer. Most higher institutions in Nigeria offering Computer Science positioned the discipline within the Mathematical Sciences as a way to broaden students' understanding of the discipline through logical reasoning contained in mathematics and so the mathematical aspects of the discipline tend to serve as an entry point to computer programming. This study therefore aims to determine the factors that influence computer science students' perception of computer programming courses. Psychological, social and environmental factors that influence students' perception in computer programming were examined to determine their influence on students' perception in computer programming. Also, the influence of method of instruction on students' perception of computer programming was examined.

Methodology

Based on the above specific objectives, the study sought to answer the following research questions:

i. To what extent does psychological factors influence students' perception to computer programming?
ii. Is there any significant relationship between social factors and their influence on students' perception of computer programming?
iii. Does environmental factors influence students' perception of computer programming?
iv. What is the relationship between physiological factors and students perception of computer programming?
v. What is the relationship between method of instruction and students perception of computer programming?

The following hypotheses were formulated to answer the research questions:

Ho1: There is no significant relationship between psychological factors and influence onstudents' perception in computer programming.

Ho2: There is no significant relationship between Social factors and influence onstudents' perception in computer programming.

Ho3: There is no significant relationship between environmental factors and influence onstudents' perception in computer programming.

Ho4: There is no significant relationship between physiological factors and influence onstudents' perception in computer programming.

Ho5: There is no significant relationship between method of instructions and influence onstudents' perception in computer programming

Piaget Theory of Cognitive Development

This study adapted the Piaget's theory of Cognitive development in an experiment to teach novice students computer programming before data was collected. The aim was to stimulate the students into a cognitive learning environment where the stages of problem solving leading to acquisition of programming skills were presented as a set of cognitive processes. Data was later collected using questionnaires, interviews and focus group discussion where the focus was on the students that participated in the experiment. Piaget described how a child constructs a mental picture of the world through four (4) stages of development: sensorimotor, preoperational, concrete operational, and formal operational[7]. While Piaget regarded cognitive development as a process which occurs due to biological maturation and interaction with the environment, computer programming skills are acquired through a developmental process acquired through instruction and learning.

Similarities between Piaget Theory of Cognitive Development and Learning Computer Programming

The Piaget theory of cognitive development and learning was adapted to learning computer programming because:

1. In Piaget theory of cognitive development children invent, construct, and modify their own projects; which is similar to computer programming that facilitate divergent thinking and creativity.
2. Piaget encourages children to reflect on acquired knowledge in order to development metacognitive abilities. This is the essence of teaching problem solving and logical reasoning in computer programming.

3. Piaget theory discussed how reflectivity is developed in children as they think about their errors and how to correct them. This is reflected in error identification and debugging in programming. Students are taught different types of errors that can occur in a program and how to reflectively place an error in its right category in order to eliminate it from the program.
4. Piaget theory shows how children apply ideas formerly thought in abstract terms for their developmental level, to accelerate cognitive development. This is similar to application of creative and logical thinking to the utilization of the correct syntax and semantics of a programming language.
5. Finally, Piaget theory described an increase in children's ability to describe directions from their own and others' perspectives from previous knowledge acquired.

This is the main objective of computer programming. Students are taught lifelong skills to create computer programs for diverse categories of users by giving explicit special comments to the computer (codes) that creates useful solutions (computer software) to solve the problems specified by users (user requirement).

The Experiment

Forty – three (43) students from the HND 2 class in Auchi Polytechnic in the 2018/2019 academic session participated in the experiment. This class was selected because the students had been taught several computer programming languages and we believe they can give an unbiased opinion of how they perceive computer programming courses. To enable the students recall the previous knowledge acquired, researcher conducted a two-day lecture guided by Piaget's stages of cognitive development following the four staged process below:

(i) Computer programming tools: This stage is similar to Piaget's sensorimotor stage when an infant's mental and cognitive attributes develop from birth until the appearance of language. Students were introduced to the concept of problem definition by presenting the various objects and tools required to solve a problem. The concept of language compilers, interpreters, preprocessors, constants, variables and data types and data structures was taught. Also, the data concept of data hierarchy was mentioned to enable students visualize the relationship between fields, records, databases, objects, entities and various other 'things' required in a programming environment. The aim was to ensure that the students create a mental picture of the objects needed in a typical programming environment.

Problem Definition/Analysis (Preoperational Stage)

The characteristics of this stage include an increase in language ability, symbolic thought, egocentric perspective, and limited logic. The students were taught how to visualize and formulate a possible solution based on the problem. Students were given the following problem solving task to stimulate them to think logically:

A girl was asked her age. She said she did not know but that she was half her mother age, when asked about her mother's age, she said she did not know but what she remembered was that her father was five years older than her mother. She was then asked 'how old is your dad', she said 'I don't know' but that if you add all their ages, the answer is 100. Now how old is the girl, her mum and her dad? Show your working.

Only three (3) out of the 43 students were able to visualize the problem and show the steps to the final solution on paper. Many of the students were gloomy at this stage which confirmed that poor logical thinking ability is one of the reasons why students perceive computer programming as difficult. The solution was given (Table 1) and this resulted in several questions.

Table 1: Test of Logical Reasoning

1. Let child's age be x 2. Let mothers age be 2x 3. Let fathers age be 2x + 5 4. Let x + 2x + 2x + 5 = 100 5. 5x + 5 = 100 6. 5x = 100 – 5 = 90 7. x = 90/5 = 19 8. mothers age = 19 * 2 = 38 9. Fathers age = 38 + 5 = 43	1 Let mother's age be x 2 Let child's age be x/2 3 Let fathers age be x + 5 4 Let x + x/2 + (x + 5) = 100 5 2x + x + 2x + 10 = 200 6 5x + 10 = 200 7 5x = 200 – 10 = 190 8 x = 190/5 = 38 9 Girl's age = 38/2 = 19 10 Fathers age = 38 + 5 = 43	Step 1. Let the mother's age be X, Step 2.Let the girl's age be x/2 Step 3.Let the father's age be (5 + X) By solving; Step 4. X + X/2 + (5 + X) = 100 Step 5.L.C.M = 2 Step 6. 2X + X + 10 + 2X = 100 x 2 Step 7. 5X +10 = 200 Step 8. 5X = 200 – 10 Step 9. 5X = 190 Step 10. X = 190/5 Step 11. X = 38 Recall that the X is the mother's age. Step 12. Now mothers age = X = 38. Step 13. The girls age is X/2 = 38/2 = 19 Step 14. The fathers age is 5 + X = 5 + 38 = 43

Engaging the students in this interaction and discussion enabled them to discover that each individual has a unique way of solving a problem and that most successful programmers discuss with their peers in order to proffer a quality solution to a problem. During this class, the concept of iterations and control structures was also introduced.

Using a questionnaire enabled the researcher to test the hypotheses formulated and drawing inferences there from.The theoretical population for this study is all HND students of Computer Science Department, School of Information and Communication Technology, Auchi Polytechnic, Auchi, Edo State. While the targeted population consist of 524 students of Computer Science Department offering computer programming courses in HND level in the institution.Sample size was statistically determined from the population size of 524 selected students using Taro Yamane's formula. The sample size of the study was determined thus;

$$n = \frac{N}{1 + N(e)^2}$$ Where;n = sample size, N = population size, e = significant level, 1 = constant

$$n = \frac{524}{1 + 524(0.05)^2}$$

$$n = \frac{524}{1 + 524(0.0025)}$$

$$n = 227$$

The sample size of this study therefore, consists of 227 randomly selected HND students of Computer Science Department, School of Information and Communication Technology, Auchi Polytechnic, Auchi, Edo State. The data collected were presented using tables; analysis was done using regression analysis and simple and simple percentage. The data analyzed was based on questionnaires successfully retrieved. Regression analysis was used to test the hypotheses.

Presentation and Analysis of Data

Table 2 presents the summary of the descriptive statistics for the variables for 198 observations. It shows that in Auchi Polytechnic, Physiological factors (PHYF) which are; sense – perception, physical health, fatigue, time of learning, food and drink, atmospheric conditions and age has a mean value of 87.9039 with standard deviation of 0.81038; Psychological factors (PSYF) which are; mental health; motivation and interest; Success, Praise and Blame; reward and punishment; has a mean value of about 82.2930 and a standard deviation of 0.8202, its maximum rating for nearly all the variables are 198.0 respectively while the minimum for nearly all the variables is 1. Environmental factors (ENVF) which are; working conditions; and organizational set – up; has mean value of 92.7501 and 0.904585 respectively. The corresponding values for Social factors which are shyness of students and lack of interaction (SOCF) are 93.6477 and 0.878535 standard deviation. The p – value of the Jarque – Bera Statistics probability of variables in test for normality showed that nearly in all the cases the data were judged to be normally distributed at 5% level of significant.

Table 2: Correlation Matrix

Correlation	PSYF	SOCF	ENVF	PHYF	MTHI
PSYF	1.0000	-	-	-	-
SOCF	0.4507	1.0000	-	-	-
ENVF	0.4397	0.5053	1.0000	-	-
PHYF	0.5000	0.5733	0.4657	1.0000	-
MTHI	0.5321	0.2392	0.3468	0.4830	1.0000

Table 2 shows that there are mixed correlations between the various variables studied in the study. The table shows positive correlation between PSYF, SOCF, ENVF, PHYF and influence of students' perception to computer programming in Auchi Polytechnic, Auchi. The table also shows that no two of the variables are perfectly correlated or nearly so. Thus, the problem of multicollinearity is absent in these models.

Discussion of findings

This study examined the relationship among factors that influence students' perception of computer programming, among the variables are psychological factors, social factors, environmental factors, physiological factors and methodology of instruction.

The results indicate that almost all the variables are significantly normally distributed at 5% level of significance. The correlation matrix indicates that the variables have mixed relationship. The explanatory variables have positive correlations with dependent variables and the result also indicated the absence of multi – collinearity.

The findings from hypothesis one shows a coefficient of 0.4825, the results indicate that psychological factors have positive influence onstudents' perception in computer programming. While the probability value of 0.0000 indicates that the

positive relationship is significant. This leads to the acceptance of the alternative hypothesis (Hi) that there is significant relationship between psychological factors and influence of students' perception of computer programming and rejection of the null hypothesis (Ho).

From hypothesis two, the findings show that a coefficient of 0.4853 the results indicate that Social factors have positive influence of students' perception in computer programming. While the probability value of 0.05630 indicates that the positive relationship is significant. This leads to the acceptance of the alternative hypothesis (Hi) that there is significant relationship between Social factors and influence of students' perception of computer programming and rejection of the null hypothesis (Ho).

From hypothesis three, with a coefficient of 0.0659 the results indicate that environmental factors have positive influence of students' perception in computer programming. While the probability value of 0.0000 indicates that the positive relationship is significant. This leads to the acceptance of the alternative hypothesis (Hi) that there is significant relationship between environmental factors and influence of students' perception of computer programming and rejection of the null hypothesis (Ho).

From hypothesis four with a coefficient of 0.3192 the results indicate that physiological factors have positive influence on students' perception in computer programming. While the probability value of 0.00182 indicates that the positive relationship is significant. This leads to the acceptance of the alternative hypothesis (Hi) that there is significant relationship between physiological factors and influence of students' perception of computer programming and rejection of the null hypothesis (Ho).

In hypothesis five, with a coefficient of 0.5792 the results indicate that methodology of instructions have positive influence on students perception in computer programming. While the probability value of 0.00321 indicates that the positive relationship is significant. This leads to the acceptance of the alternative hypothesis (Hi) that there is significant relationship between methodology of instructions and influence of students' perception of computer programming and rejection of the null hypothesis (Ho).

From the context analysis of the experiment, the study revealed the following findings;

i. **On "Do you like programming**?', 31 (72%) of the respondents said "Yes" because it is a creative process that enables the mind to create and developmental models on possible solutions to real world problems. While 12 (28%) said "No" that programming is complex and difficult to understand.

ii. '**Did you enjoy the class**? 27 (62%) of the respondents said "Yes" that they enjoyed the class because experiment was conducted to teach them problem solving skills that can gradually introduce them to computer programming. While 16 (38%) response "No" that the class was not interesting.

iii. '**Do you like coding?'. 25 (**58%) of the students said yes that coding is a good skill for programming, while 18(42%) said "No" that coding requires mathematical skills and hence it is difficult and complex.

iv. **'Did the class change your view about programming?**' 39 (90%) said yes that the experiment was helpful and helped to change their view about learning computer programming. While 4 (10%) said "No" that computer programming is difficult and complex and that the class did not affect their opinion.

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

Findings

i. The results indicate that psychological factors and environmental factors have positive influence on students' perception to computer programming, so there is significant relationship between psychological factors, environmental factors and influence of students' perception to computer programming.

ii. This shows that Social factors have positive influence on students' perception to computer programming. This leads to the acceptance of the null hypothesis (Ho) that there is no significant relationship between Social factors and influence of students' perception to computer programming and rejection of the alternative hypothesis (Hi).

iii. Physiological factors and Methodology of instructionhave positive influence on students' perception to computer programming. That shows there is significant relationship between physiological factors, Methodology of instruction has significant relationship with influence of students perception to computer programming.

iv. The result of experiment class revealed that majority of the class like computer programming as it enabled them to proffer solution to problems, teach them problem solving skills, good skill for programming, and that the experiment class was helpful and helped to change their view about learning computer programming from being difficult to easy understanding and not complex.

Conclusion

Computer Programming courses coverthe foundation of the basic computer programming. This is the stage where the students will be able to develop the analytical skills that they will use throughout their study of the chosen IT career or

field. This is one of the courses that students find difficult to comprehend and cope with during their studies. The findings gathered and revealed that given the numerous indicators for each possible factor that influence students' perception and academic performance in the course, psychological, physiological, environmental, method of instructions and social factors influence students' perception of computer programming. Conclusively, psychological, factors, physiological factors, environmental factors and method of instructions significantly influence students perception in computer programming and social factors has no significant influence on students' perception of computer programming. Finally, experiment class revealed that majority of the class like computer programming as it enables them to proffer solution to problems, teach them problem solving skills, good skill for programming, and that the experiment class was helpful and helped to change their view about learning computer programming from being difficult to easy to understanding and not complex.

Recommendations

i. Computer based training programming should be given to students to be more confident to use computer applications in their day to day activities. Initiatives can be given by the government to the school administrators to make them use computer program related tools to kindle their interest towards computer science career.
ii. Effort should be on education by influencing the students learning as being technological and cultural functions. By computer, students can catch stable, contemporary knowledge with its multi-functional tools. While thinking contemporary educational context, dealing with application of knowledge, research for learning become vital part on students and educators environment.
iii. In addition to this, there should be support on the need of students in computer education to get efficient studies in order to get related knowledge of computer programming. At these, following new trends and tendency to use computers in order to help future success of students in computer programming. Because of these reasons, people should accept that computer programming has a great influence on educational context. As a result, computer can work better as a great influencer and creating active learning for students and easy way to solve educational and study-based problems instead of being problematic for their life.

APPENDIX II

QUESTIONNAIRE

Please tick(x) appropriately

Section A:

1. Gender: Male ( ) Female ( )
2. Age 21 – 30 years ( ), 31 – 40 years ( ), 41- 50 years ( ), 51 years and above ( ).
3. Educational Background: Basic Education ( ), SSCE ( ), OND ( ), HND ( ), B.Sc ( ), M.Sc ( )
4. Years of Experience: 1 – 10 years ( ), 11 – 20years ( ), 21 – 30 years ( ), 31 years and above ( )

Section B:

S/NO	QUESTIONS	YES	NO
	Physiological factors		
5.	Would your sense of perception prefer programming courses only as computer science students?		
6.	Does computer programming evaluation require physical health as part of assessment in programming courses?		
7.	Is fatigue compulsory in writing programs?		
8.	Does attitude of students towards programming courses lead to lack of interest?		
9.	Does programming help to instill confidence in students of computer science?		
10.	Does lack of atmospheric condition in programming related courses have something to do with teaching method?		
	Psychological factors		
11.	Does motivation of students improve their perception of computer programming?		

12.	Does mental tension affect students' perception of computer programming?		
13	Does rewards and punishment affect students' perception in computer programming?		
	Social factors		
14.	Does the thought of writing computer programs excite you?		
15.	Do you like the current teaching method adopted for teaching programming courses?		
16.	Do you have supervised practical periods for programming?		
17.	Is passing a lower level programming course pre – requisite for higher level course?		
18.	Does programming courses contribute to students' exposure in computer science courses?		
19.	Will effective supervision of programming courses ensure effective knowledge of computer programming?		
	ENVIRONMENTAL FACTORS		
20.	Is lack of facilities a cause of your dislike for programming?		
21.	Does effective use of programming course can yield finance to students?		
22.	Does non – availability of network structure in your class room lead to lack of interest in computer programming?		
23	Does lack of conducive classroom for teaching lead to less interest in computer programming?		
24.	Is lack of trained programmer an impediment of your interest in computer programming?		
25.	Is lack of instructional technologists a cause of lack of understanding of computer courses?		
	METHODOLOGYOF INSTRUCTIONS		
26.	Would presentation and organization of materials affectstudents' perception in computer programming?		
27.	Does practical activity affectstudents' perception in computer programming?		
28.	Does proper timing of lecture or programming course increase students perception of computer programming?		

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