Assessment of The Relationship Between Self-Efficacy, Achievement and Institution Type in Java Programming in South-Western Nigerian Universities

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Abstract

The aim of this study was to assess the relationship between students' self-efficacy and achievement in Java programming among computer undergraduates in South-Western Nigeria. It was also aimed at testing the significance of institutional type differences in self-efficacy and achievement in Java programming. The Java programming self-efficacy scale (r = 0.96) and achievement test (r = 0.70) were completed by 254 students across both Federal and State owned public universities in South-Western Nigeria. By using Pearson correlation, the relationships between self-efficacy and achievement in Java programming was investigated and by using inferential statistics (t-test), significant difference of self-efficacy and achievement across institution type was tested. The analysis of the data indicated a significant relationship between self-efficacy and achievement in Java programming ($r = 0.249$, $p < 0.05$). It also showed a significant difference in self-efficacy scores of students across types of institutions (Federal and State universities) ($t = 7.57$, $p > 0.05$), but a non-significant difference in achievement ($t = 45.92$, $p < 0.05$). Based on the findings from the study, it was recommended among others that efforts be made to improve self-efficacy of students (especially those in the Federal government-owned universities) in Java programming as it relates positively and significantly with their achievement.

Keywords: Achievement; Assessment; Institution type; Java Programming; Self-efficacy

1. Introduction

Computer programming skill is a major aspect of computer science which is needed not only by the computer professionals but also by the non-computer professionals. For computer professionals, acquisition of programming skills is inevitable, because a computer is quite useless unless it is running a program. Programming lies at the very heart of computer [1]. Programming courses are not just about programming perse, they also provide a forum for teaching precise and logical thought processes [2]. Moreover, they constitute necessary background for computer science students by introducing basic concepts and techniques to be used and to be built upon in more advanced computer science courses. An understanding of how the programs are written is a key part of the development of any computer science student. It is therefore not surprising that computer undergraduates are required to take and pass some programming courses during the course of their training.

Computer programming is the craft of writing useful, maintainable and extensible instructions which can be interpreted by a computer system to perform a meaningful task. Precisely, programming has been defined as; "the process of taking a problem specification written in plain language, understanding it, devising a solution, and then converting the solution into a correct computer program (usually expressed in some special-purpose programming language)" [1]. To program using the computer, one must learn how to give instructions to it. One must also learn the language understood by the computer. The instructions you give to the computer must be according to some specified rules. The words which make up the instructions as well as the rules which the instruction must obey form the computer language. In giving instructions to the computer, it must be done in any of the computer programming languages. Several computer programming languages had been developed and are still being developed.

There are several programming languages studied in the Nigerian Universities. Java programming language has been chosen for this study because it is taught presently in most public universities in south – west, Nigeria. It is also more relevant in the industries today and works on the web browsers.

Research reports shows a consistent decline in number of students choosing computer science programme at the undergraduate level [3,4 and 5]. Since there has been a rising demand of computer scientists and programmers for employment in the industries, the need to increase students' participation in computer science programme becomes inevitable [5]. The perceived difficulty, boredom and absence of social interaction might be responsible for students' reluctance to choose computer science [6]. Consequently, students tend to have low self-efficacy, which in turn affects their commitment and perseverance in programming and consequently their achievement in the same.

Institutions have been found to make a difference in students' achievements whether in mathematics or computer programming. The level of influence however differs as shown in the following: In South Korea, about 4% of the total variance of mathematics achievement was due to institutional – level factors [7] while for south African students it was 55% [8]. For Australian students 27% and 47% formed the percentage contributions of institutional – level differences in the Trends in mathematics and science study (TIMSS) conducted in 1995 and 1999 respectively [9]. In Singapore 45%, Botswana 27%, Chiki 30% and Flenders 14% were the percentage contributions found [10,11,12 and 13]. Recently, a study carried out among eight graders in Malaysia indicated that 57.28% of the total variance in mathematics achievement of

eight graders in Malaysia was accounted for by institutional level differences [14]. Also in a study on school effectiveness in mathematics and science at the 4th grade, using data from International Educational Assessment (IEA's) TIMSS study where 14 countries were included in the study, about one – quarter (25%) of the variability in mathematics and science achievement was found to lie between schools.

Institutional type was also found to influence self-efficacy as students in private schools in Sweden performed significantly better on the reading test than did students in public schools since their teachers are more efficacious [16 and 17, 18, 19 and 20]. Studies that evaluated the relationship between achievement and self-efficacy of Java programming language and the significant differences in the two concepts across institution type (in particular Federal and state institutions in Nigeria) are very rare and this is what this study sought to do.

2. Purpose of the Study

The study sought to carry out the following:

1. Assess the relationship between achievement and self-efficacy of computer undergraduates in Java Programming.
2. Assess the difference between the Java programming achievement of computer undergraduates in Federal and State government owned universities.
3. Assess the difference between the Java programming achievement of computer undergraduates in Federal and State government owned universities.

3. Research Hypotheses

The following research hypotheses were tested:

1. There is no significant relationship between achievement and self-efficacy of computer undergraduates in Java programming.
2. There is no significant difference, in the mean score of achievement in Java Programming, between undergraduates in Federal and State Universities.
3. There is no significant difference, in the mean score of self-efficacy in Java Programing, between undergraduates in Federal and State Universities.

4. Methodology

This study adopted purposive sampling for the selection of participants' universities and levels of study. The Universities of respondents were selected based on the following criteria; (i) the university is owned by federal or state government, (ii) there is a computer science department where potential computer professionals are being trained, (iii) Java programming language is taught in the computer science department of the university. In all, at the time of the study, five (5) public universities within the South – West, Nigeria satisfied the three criteria above. One of them was used for the pilot test, validation and reliability of the instruments before the main study. The remaining four (4) public universities were used for the real study. Each participant used was selected based on the following criteria: (i.) he / she is a full time student in the Department of Computer Science in any of the chosen Universities; (ii.) he / she had been taught Java programming Language; (iii.) he / she is available at the time of data collection and (iv.) he / she is patient and willing to participate in the study. A total of 254

computer undergraduates participated in the study by attempting the Java programming achievement test and filling the self-efficacy scale.

The instrument used for the study were the Java programming achievement test and Java self-efficacy scale. Two faculty members from two separate universities validated the Java programming achievement test, the final copy was produced after effecting the corrections. The reliability coefficient using Kuder-Richardson 20 formula was found to be 0.70. The Java Programming Self-efficacy scale was the adapted version of the C++ programming Self Efficacy Scale [21]. It consisted of 32 items. The participants were given instructions to rate their confidence in understanding and doing the Java programming related tasks using a scale of 1 (Not confident at all) to 7 (Absolutely confident). Administration of the instrument on Engineering undergraduates in Turkey who had been instructed in Java programming produced a reliability of 0.99 [22]. In the current study, the instrument was pilot tested on computer undergraduates in south-west, Nigeria and the reliability coefficient was found to be 0.96. It was therefore found to be very reliable and fit to be used. The instrument as it is, was therefore adopted for the study. Data was analysed using mean, standard deviation, correlation, regression and t-test.

5. Result

Hypothesis One:

There is no significant relationship between achievement and self-efficacy of computer undergraduates in Java programming.

Table 1: The Relationship between Achievement and Self-efficacy in Java programming (N = 254)

		1	2
1	PPMC	1.000	0.249*
	P-value	.	0.000
2	PPMC	0.249*	1.000
	P- value	0.000	.

Key: 1 – Java Programming Achievement, 2 – Java Programming Self-efficacy

PPMC – Pearson Product Moment Correlation; P-value – Significant value

** Correlation is significant at the 0.05 level (2 tailed)*

Table 1 presents the pearson product moment correlation coefficient for the relationship between Java programming achievement and Java programming self-efficacy. A weak positive correlation that was significant was found ($r = 0.249$ $p < 0.05$). Therefore, Java programming achievement has a weak positive relationship with the Java programming self efficacy. The implication of this finding is that computer undergraduates with higher self efficacy perform better in Java programming achievement.

Hypothesis Two:

There is no significant difference, in the mean scores of achievement in Java Programming between computer undergraduates in Federal and State Universities.

Table 2: T-test comparison of Achievement in Java Programing, Between Undergraduates in Federal and State Universities.

Inst. Type	N	Mean	S.D	t_{cal}	Df	p-value	Remark
Federal	194	20.54	18.72	8.67	252	0.250	N.S
State	60	22.92	11.78				

N.S – Not Significant

Table 2 presents the t-test comparison of the scores of achievement in Java Programing, between undergraduates in Federal and state universities. The t-test comparison showed a difference which is not statistically significant between the mean scores of achievement in Java Programing in Federal and State Universities (Tcalculated = 8.67, df = 252, $p > 0.05$). We therefore accept the null hypothesis. Therefore, there is no significant difference, in the mean score of achievement in Java programing, between undergraduates in Federal and State Universities.

Hypothesis Three:

There is no significant difference, in the mean scores of self-efficacy in Java programming between computer undergraduates in Federal and State Universities to test the hypothesis, independent smple t-test was used.

Table 3: T-test comparison of Self-Efficacy in Java Programing Between Undergraduates in Federal and State Universities

Inst. Type	N	Mean	S.D	t_{cal}	Df	p-value	Remark
Federal	194	128.05	44.57	7.57	252	0.001*	S
State	60	173.97	26.39				

S – Significant

Table 3 presents the t-test comparison of the scores of self-efficacy in Java Programming, between undergraduates in Federal and state universities. The t-test comparison showed a statistically significant difference between the mean scores of self-efficacy in Java Programming, between undergraduates in Federal and State Universities (Tcalculated = 7.57, df = 252, $p < 0.05$). We therefore reject the null hypothesis. Therefore, there is a significant difference in the mean score of self-efficacy in Java programming between undergraduates in Federal and State Universities.

6. Discussion

As shown in table 1; Java programming achievement related positively and significantly with Java programming self-efficacy, meaning the higher the self-efficacy the higher the achievement in Java programming. There are also other researches that showed positive relationship between the self-efficacy and self- regulated learning and academic achievements [23,24 and 25].

The result in table 2 showed a difference which is not statistically significant in the mean achievement scores across institution type. Variance in achievement due to institutional – differences varies from one place to another. In South Korea, about 4% of the total variance of mathematics achievement was due to institutional – level factors [7]. For south African students it was 55% [8]. Similarly, for Australian students 27% and 47% formed the percentage contributions of institutional – level differences in the Trends in mathematics and science study (TIMSS) conducted in 1995 and 1999 respectively [9]. In Singapore 45%, Botswana 27%, Chiki 30% and Flenders 14% were the percentage contributions found [10,11,12 and 13]. Recently, a study carried out among eight graders in Malaysia indicated that 57.28% of the total variance in mathematics achievement of eight graders in Malaysia was accounted for by institutional level differences [14]. Also another study on school effectiveness in mathematics and science at the 4th grade, using data from International
Educational Assessment (IEA's) TIMSS study where 14 countries were included in the study gave that about one – quarter (25%) of the variability in mathematics and science achievement was found to lie between schools. In the present study however, state universities had higher mean achievement scores when compared with their federal university counterparts; although the difference is not significant. The non-significant difference in the mean achievement in Java programming across institution type as observed among the respondents of this study suggests that both types of public universities require attention in the bid to step up achievement in Java programming.

The result in table 3 showed a significant difference in the mean self-efficacy scores across institution type; with the state universities having higher mean scores. This finding is in agreement with that of a study carried out to determine the extent to which teacher self-efficacy could enhance secondary school students' achievement [26]. Teachers form part of the institution and hence could be used to explain institutional differences. The study confirmed that teachers frequent use of mathematics homework and level of interest and enjoyment of mathematics as well as their ability and competence in teaching mathematics played a key role in promoting students mathematics self-efficacy [26]. To boost students' self-efficacy in computer programming, students should not only be the focus, the institutions must also create an enabling environment. In this work the mean scores in table 3 showed a higher mean self-efficacy score from the undergraduates in state university. It therefore follows that the mean self-efficacy in Java Programming of undergraduates in the state universities (mean = 173.97, standard deviation = 26.39) is significantly higher than that of their counterparts in the Federal universities (mean = 128.05; standard deviation = 44.57). The higher mean self-efficacy score in the state-owned institution could be explained by the fact that unlike in the federal universities, the state universities are used to providing and doing things for themselves. Consequently, ownership of computer which is expected to be more in the state owned universities might have impacted positively on their self-efficacy in Java programming.

7. Conclusion

The findings of the study showed the following: (i) a significant relationship between self-efficacy and achievement in Java programming, (ii) a non-statistically significant difference in achievement between federal and state government owned universities and (iii) a significant difference in the self-efficacy scores between Federal and State owned universities.

8. Recommendations

The following recommendations were made:

There is the need to work on undergraduates' self-efficacy so that achievement can be improved.

Focus should be on federal government owned schools in south west, Nigeria in the bid to improve self-efficacy of undergraduates.

More researches to be carried out on factors that influence self-efficacy in computer programming especially in federal government-owned universities within South-West, Nigeria.

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