Cognitive Style as A Predictor of Secondary School Students' Achievement in Computer Studies in Onitsha Education Zone

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Abstract
The study investigated cognitive style as a predictor of secondary school students' achievement in computer studies in Onitsha Education zone. Two research questions and two null hypotheses guided the study. The design adopted for the study was Predictive correlational. The population of the study was 5, 455 senior secondary year two (SS2) students offering computer studies in the zone. A sample of 1,000 students drawn using multi-stage sampling procedure involving random and purposive sampling techniques was involved in the study. The instrument for data collection was Cognitive Style Test (CST) validated by three experts in Nnamdi Azikiwe University, Awka. The reliability of CST established using Kuder-Richardson Formula 20 which yielded reliability coefficient value 0.93. The students' achievement scores in Computer studies for two terms were obtained and the average scores were used as the students' achievement in Computer studies. The data obtained were analyzed using simple and multiple linear regressions. The findings of the study revealed among others that 0.4% of the variance in achievement in Computer studies was predicted by cognitive style. Also, achievement scores in computer studies was significantly predicted by students' cognitive style. It was recommended that instructional objectives should be drawn across activities needing teachers' directives and guidance and those not needing the teachers' guidance in order to afford both the field dependent and field independent learners the opportunity to properly understand what is taught.

Keywords: *Cognitive, Achievement, Computer, Predictor, Regression*

Introduction

Students' achievement in computer studies have not improved satisfactory as expected despite the importance of computer studies and efforts at various levels to ameliorate the challenges of learning the subject. The WAEC Chief examiner since the inception of the subject in 2014 till date has continued to point out certain areas of poor achievement that are disturbing and are of interest to researchers, manifested by the candidates who enrolled for the subject. On general note the Chief examiner reported lack of computer skills among students, a very important goal of the computer studies curriculum. The Chief Examiner although blames the problem as owing to lack of continuous practical classes for students, nothing is known about how the students' cognitive style may influence the students' learning of computer studies and their academic achievement in the subject.

The cognitive processes which sometime bind incoming information with previous one, is thought to occur in the focus of attention as is seen in the Embedded-Processes model of working memory (Niaz, De-Nunez and De-Pineda, 2021). A student's WMC could play a significant role in the cognitive process that take place during the learning of novel information as is peculiar with computer studies introduced into the secondary school level in 2014. WMC may therefore predict students' achievement in computer studies. However, there is the possibility that where students have just sufficient WMC to improve computer studies achievement, learning might be impeded by the manner in which students perceive information and the pattern of thoughts used to develop a knowledge; a concept known as cognitive style.

Cognitive style according to Ufomadu and Okoli (2019) is a person's characteristic mode of perceiving, thinking, remembering, and problem solving. Cognitive style or thinking style is a concept used in cognitive psychology to describe the way individuals think, perceive and remember information. It is a person's habitual, prevalent, or preferred way of thinking. Unlike individual differences in abilities, Ogan (2012) asserted that cognitive style describes a person's typical mode of thinking, perceiving, remembering, or problem solving. It denotes the information processing methods of an individual. According to Witkin (1962) theory of cognitive style, human perceptions are differentiated into field-dependent, field neutra and field-independent styles.

In general, people who exhibit field dependence tend to rely on information provided by the outer world, the field or frame of a situation and their cognition (toward other things) is based on this overall field. Such individuals perceive information from external cognitive loads identified by Sweller as earlier mentioned. Field dependent students consistently relies more on external referents (environmental cues) than on internal referents (bodily sensation cues). Field dependent people make greater use of external social referents, but only when the situation is ambiguous and these referents provide information that helps remove the ambiguity.

On the other hand, field independent students prefer learning autonomy and like to direct their own learning (Oludipe, 2014). They tend to be able to disregard deceptive environmental cues, particularly in tasks requiring the performance of simple actions or the identification of familiar elements in unfamiliar contexts. In this study, Field Dependence–Independence are dimensions of cognitive styles designed to measure an individual's ability to identify embedded parts of an organized visual field as entities separate from that given field. Studies on cognitive style are necessary to provide evidenced-based practices to improve school learning.

Cognitive style according to Margaret (2015) influences the teaching-learning process and classroom behaviour which determines the classroom culture and student teacher learning. In the context of globalisation and information age, the speed of social change and knowledge construction has taken enormous change in the field of education. Thus, knowledge gained concerning cognitive styles provides the opportunity to learn more about individual differences. This knowledge can then be applied to assist teachers, counselors, and all professionals who are involved in students' learning and to provide best cognitive learning experiences for each cognitive style. Cognitive learning experiences are powerful alternative to the traditional classroom approach because instead of focusing on memorization, cognitive learning builds on past knowledge (Lusweti, Kwena and Mondah, 2018). Therefore, it is important that research studies explore the predictive influence of cognitive style on students' academic achievement in computer studies.

Purpose of the Study

The purpose of the study was to determine cognitive style as a predictor of secondary school students' academic achievement in computer studies in Onitsha Education Zone. Specifically, the study determined the:

1. Predictive power of cognitive style on students' achievement in Computer studies.
2. Contribution of the individual dimensions of cognitive style (field dependent, field Neutral and field independent) in the prediction of students' achievement in Computer studies.

Research Questions

The following research questions guided the study:

1. What is the predictive power of cognitive style on students' achievement scores in computer studies?
2. What is the contribution of the individual dimensions of cognitive style (field dependent, Field Neutral and field independent in the prediction of students' achievement scores in computer studies?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

1. Students' cognitive style scores does not significant predict of academic achievement in computer studies.
2. The contribution of the individual dimension of cognitive style (field dependent, Field Neutral and field independent) in the prediction of students' achievement scores in computer studies is not significant.

Method

The design of the study was predictive correlation design. The area of the study is Onitsha Education Zone of Anambra state. The population of the study is 5, 455 senior secondary year two (SS2) students offering Computer studies in 2022/2023 academic session. The sample for the study was 1100 SS2 students offering Computer studies in Onitsha Education Zone. The sample for the study was obtained using multi-stage procedure. The stage by stage procedure is as follows: simple random sampling was used to select 25 schools (balloting with replacement) from the three local government areas in Onitsha Education Zone. Secondly, in each of the schools selected, computer studies students were purposively selected. The criterion for selection was that the students' result for two terms in computer studies is comprehensively recorded in the teachers' diary.

The instrument for data collection was Cognitive Style Test (CST). Cognitive Style Test (CST) was adopted from Group Embedded Figures Test (GEFT) developed by Witkin, Oltman, Raskin and Karp (1971). It measures individuals' levels of field independency by tracing simple forms in the larger complex figures. The test instrument consists of 25 items. In scoring, the total score is the number of figures that are correctly traced and the possible maximum score is 100. Generally, the GEFT manual provides guidelines to identify different types of cognitive styles (Field Independent, FI, Field Neutral, Field Dependent, FD) by displaying the norms.. According to the norm, students who scored above 50% are field independent and those who scored below 40% are field dependent. The score inventory of the students for two terms was obtained and the average determined and used as students' achievement in Computer studies.

The instrument was validated by three lecturers in the Department of Science Education and one other in the Department of Educational Foundations for validation. The reliability of CST and RST was established by the researcher using Kuder-Richardson formula 20 (KR-20)

because they have heterogeneous level of difficulty. The coefficient of international consistency obtained for CST was 0.93. The instruments were administered to the students with the aid of four research assistants. Data generated from the study were analyzed using simple linear and multiple regressions. The coefficient of determination was used to explain the variation in the outcome variable that was attributed to the predictor variables. The null hypotheses were tested at 0.05 level of significance using simple and multiple linear regression. The decision rule was that whenever Pvalue is less than or equals 0.05 ($P \leq 0.05$) the null hypothesis was rejected and was not rejected whenever Pvalue is greater than 0.05 ($P > 0.05$).

Results

Research Question 1: What is the predictive power of cognitive style on students' achievement scores in computer studies?

Table 1: Prediction of Students' Achievement in Computer Studies by Cognitive Style

Model	R	R^2	Adjusted R^2	Unstandardized coefficients (B)	Std. Error
Constant Cog. Sty.	-.063[a]	.004	.003	74.086 -.407	14.751

a. Predictors: (Constant), Cognitive Style

Table 1 shows that a low negative relationship (R = 0.063) exists between students' cognitive style and their achievement in computer studies. The R-Square value of 0.004 indicates that 0.4percent of the variance in computer studies scores is predicted by cognitive style. The unstandardized coefficient B of -0.407 shows that, a unit increase in cognitive style specifically at the border lines, from field dependence (0-6) through field neutral (6-12) to field independence (13-18), reduces academic achievement in computer studies by 0.407.

Research Question 2: What is the contribution of the individual dimensions of cognitive style (field dependent, field neutral and field independent in the prediction of students' achievement scores in computer studies?

Table 2: Contributions of the Individual Dimensions of Cognitive Style in the Prediction of Academic Achievement Scores in Computer studies

Model		Unstandardized Coefficients		Standardized Coefficients	t	Pvalue
		B	Std. Error	*β*eta		
1	(Constant)	69.817	.535		130.477	.000
	Field Dependence	.460	1.910	.007	.241	.810
	Field Independence	.971	1.044	.028	.930	.352

a. Dependent Variable: Computer studies Achievement

Table 2 shows the standardized beta coefficient which indicates correlation between variables. The unstandardized B coefficient shows the prediction powers of each dimension of cognitive style which indicates their relative contribution to achievement in computer studies. The table shows that field dependence has a low positive predictive relationship (R = 0.007) with students' achievement in computer studies while field independence has a low negative relationship (R = -0.028) with achievement in computer studies. Table 2 also reveals that a unit increase in field dependence contributed 0.460 to achievement in computer studies and whenever a students' cognitive style of field independence increased by 1 unit, academic

achievement in computer studies decreases by -0.971. The order of relative contribution to achievement in computer studies from the highest to lowest by each dimension of cognitive style is; field independence (-0.971), followed by field dependence (0.460). Field neutral was however found to be highly multi-collinear with other dimensions and was therefore eliminated from the model.

Hypothesis 1: Students' cognitive style scores is not a significantly predictor their academic achievement in computer studies.

Table 2: Significance of Prediction of Achievement in Computer studies by Cognitive Style

Model		Sum of Squares	df	Mean Square	F	Pvalue
1	Regression	957.920	1	957.920	4.402	.036[b]
	Residual	238913.265	1098	217.589		
	Total	239871.185	1099			

a. Dependent Variable: Computer studies Achievement
b. Predictors: (Constant), Cognitive Style

Table 2 shows that cognitive style predicted the students' achievement scores in computer studies significantly, F (1, 1098) = 4.402, p < .05. The null hypothesis was therefore rejected implying that students' cognitive style scores is a significant predictor of their academic achievement in computer studies. Since cognitive style is a significant predictor of achievement scores in computer studies, the regression model (Y= a + bX) for the prediction of achievement score in computer studies as derived from Table 1, where constant = 74.086 and b value = -0.407 is:

CSA = 74.086 - 0.406(Cog. Sty.)

Where, CSA = Computer studies Achievement score and Cog. Sty. = Cognitive Style Score

Hypothesis 2: The contribution of the individual dimension of cognitive style (field dependent, field neutral and field independent) in the prediction of students' achievement scores in computer studies is not significant.

Table 4: Significance of Prediction of Students' Achievement in Computer studies by the Dimensions of Cognitive Style

Model		Sum of Squares	df	Mean Square	F	Pvalue
1	Regression	220.343	2	110.172	.504	.604[b]
	Residual	239650.842	1097	218.460		
	Total	239871.185	1099			

a. Dependent Variable: Achievement
b. Predictors: (Constant), Field Independence, field dependence

Table 4 shows that the dimensions of cognitive style is a significant predictor of achievement scores in computer studies, F (1, 1097) = 0.504, p > 0.05. The null hypothesis was therefore not rejected implying that the individual dimensions of cognitive style do not significantly predict secondary school students' achievement scores in Computer studies. Table 2 shows that field dependency is not significant predictor of achievement scores in computer studies, t(1, 1097) = 0.241, p > 0.05 and field independency is also not significant predictor of achievement scores in computer studies, t(1, 1097) = -0.930, p > 0.05.

Discussion

The findings of the study revealed that cognitive style significantly predicted 0.4percent of academic achievement scores in computer studies and decreases academic achievement by -0.407 when increased by a unit. The cognitive style of individuals has been found to have a notable impact on their perceptions of utility, ease of use, and subjective norms. The cognitive style of students has a significant role in shaping their learning processes and facilitating the development of metacognitive skills. Consequently, individuals are less effectively prepared to cultivate their problem-solving abilities, which can then be applied to analyse complex circumstances as is common with learning computer studies when they manifest various dimensions of cognitive style. However, by facilitating the development of problem-solving skills and enhancing understanding abilities, an individual's cognitive style can also have a positive impact on learners' self-assurance. Such attribute provides learners with the necessary abilities to effectively address difficult and intricate problems, consequently reducing the perceived difficulty of unfamiliar subjects and providing learners with the self-assurance required to explore new areas.

The findings of the study also indicated that field independence had a considerable predictive effect on academic achievement in computer studies, making a more substantial contribution compared to field dependence. The style of field independence has the potential to facilitate the learning process by enabling learners to establish connections between their pre-existing knowledge and new information, as they exhibit minimal reliance on external resources for acquiring knowledge. The cognitive style known as field independence fosters a positive attitude towards learning by imbuing it with elements of excitement, engagement, and fulfillment. Existing literature has demonstrated that students who are field independent exhibit much higher academic performance compared to those who are field dependent. This disparity in performance can be attributed to the superior problem-solving skills possessed by field independent students, which are considered to be a vital determinant in the effective teaching and learning of scientific subjects like computer studies. This phenomenon can be attributed to the fact that individuals who exhibit field independence as a learning style do not depend on external factors to motivate their learning endeavours. Instead, they establish their own objectives, draw upon internal sources of reinforcement, and are inclined to develop their own approaches to the learning process.

In addition to the presence of variations in the personality traits of individuals classified as field-dependent or field-independent, there are also disparities in the cognitive strategies employed by these two cohorts for information processing. Students that exhibit field independence are likely to do more effectively in analytical tasks. Such individuals possess the ability to effectively address intricate problems, retrieve information from memory, differentiate between factual and fictional elements, distinguish pertinent from extraneous information, perceive an object as distinct from its surroundings, establish a framework in the absence of inherent structure, exhibit swift and accurate information encoding capabilities, and perform admirably on standardised assessments. Individuals who exhibit field-independent cognitive styles often possess enhanced analytic abilities, which in turn predispose them towards pursuing scientific and mathematical disciplines including computer science. Analytical thinkers possess a higher level of introspection, exhibit greater autonomy, prioritise mastery, exercise caution, and demonstrate a reduced susceptibility to distractions within the classroom setting. These traits are seen as essential traits for the acquisition of knowledge in the field of computer studies.

The findings of the study are in line with the findings of Arisi (2011) there was a significant main effect of cognitive style in student's academic achievement in social studies and that field Independent students performed significantly better than field dependent social studies student. The findings of the study support the findings of Sara, Maruta and Olarinoye (2016) that cognitive styles of field dependence, field-independence and field Neutral were significantly related to achievement in science process skills. The findings of the study collaborate with the findings of Asikhia (2019) and Oladotun (2020) that cognitive style significantly predicted the academic performance of students. The findings of the study are however, at contrast with the findings of Ghanbari, Papi and Derakhshanfard (2020) that there was no correlation between any of the thinking styles and students' achievement.

Conclusion

The conclusion drawn from the findings of the study is that cognitive style is a significant predictor of academic achievement in computer studies. This is to say that, cognitive style all play significant role and influences academic achievement in computer studies positively.

Recommendations

The following recommendations are made based on the findings of the study:

1. Learning strategy adopted by computer studies teachers should be somewhat individualized, as different students prefer or need certain strategies for particular tasks. Such strategy should provide students with a mechanism to evaluate their own progress and to evaluate the success and the value of the strategies in multiple tasks.
2. Instructional objectives should be drawn across activities needing teachers' directives and guidance and those not needing the teachers guidance in order to afford both the field dependent and field independent learners to properly understand what is taught.

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