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Mediating Influence of Academic Self-Efficacy on the Nexus between Cognitive Engagement and Learning Outcome of Secondary School Students

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Authors' contributions

This work was carried out in collaboration between both authors. Author VM designed the study, wrote the manuscript, collect and analyzed the data. Author AU reviewed the manuscript and supervised the work. Both authors read and approved the final manuscript.

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ABSTRACT

The purpose of this study was to examine predictions of a model explaining mediated effects, direct and indirect, of academic self-efficacy on the relationship between cognitive engagements and learning outcome in a sample of 380 Senior Secondary School Students [mean age = 15.84±2.56]. The questionnaire was used to collect data on cognitive engagement and academic self-efficacy while learning outcome was measured via performance test in three subjects administered in the classroom. Data collected were analysed by software; LISREL version 9.30. The results strongly supported the model demonstrating that deep cognitive processing and persistence directly predicts learning outcome and indirectly predicts learning outcome when mediated by academic self-efficacy. Shallow cognitive processing poorly predicts academic self-efficacy and negatively predicts learning outcome. As expected, academic self-efficacy directly predicts learning outcome. The study concludes that the impact of cognitive engagement on learning outcome of students can be greatly enhanced by their level of self-efficacy.

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Keywords: Academic self-efficacy; cognitive engagement; learning outcome; mediation; path analysis.

1. INTRODUCTION

Lack of success as a result of learning is accounted for by many factors such as student's poor academic self- efficacy and cognitive engagement, which are often neglected during classroom teaching and learning, assessment or evaluation of students' success or failure in examinations. Academic achievement is one of the most important indicators of learning and understanding in all educational systems. Students with higher academic achievement are more likely to finish high school and succeed in their future academic and professional lives [1]. Students' academic achievement is associated with their cognitive strategies. According to this assumption of the theory of processing levels [2], different types of cognitive strategies lead to different levels of learning and achievement. Several types of research have shown that the use of deep strategies is associated with higher achievement [3,4,5].

Cognitive engagement requires effort, specifically channelled toward setting goals as well as investment in learning such as perceptions of task value and perceived control [6]. Cognitive engagement explains the extent to which students' are willing and able to invest in the learning task at hand. The engagement includes the amount of cognitive effort students are willing to spend in working on the task [7], and how long they persist [8,9]. Cognitive engagement is related to an individual's desire to commit and succeed in relation to personal obligations and goals; cognitive engagement is positively associated with completing school, mastering the work, coping with difficulties that may arise, and producing passing grades [10].

Another term studied in relation to cognitive engagement, which also has various definitions is self-efficacy. It is described as a person's belief to overcome a situation [11]. Bandura [12,13] defines the term as the belief in one's ability to produce desired academic results. If students believe they can complete a task, they will have stronger engagement with this task. Self-efficacy refers to people's judgments about their ability to perform a particular task. Task-related self-efficacy increases the effort and persistence towards challenging tasks; thus, snowballing the probability that they will be completed. Conversely, if students have little confidence knowing that they can complete a task, they consider the task to be unnecessary, and consequently, do not want to spend time and energy on it. As a result, they do not engage in such a task. However, research results show students with high levels of engagement have more self-efficacy than those with lower levels of engagement [14]; these students were observed to have spent more time on learning [15]. Based on these related findings, self-efficacy was observed to be effective in attaining objectives and in increasing academic success [16]. Students with high levels of self-efficacy prefer deep learning to superficial learning [17]. In research studies of cognitive engagement and self-efficacy, these variables were seen to be highly related [18,19].

The relationship between cognitive engagement and self-efficacy is more significant in high-school students. Ransdell [20] discussed the variables affecting academic performance. One of these variables was given as self-confidence on classroom activities. Additionally, students with high levels of engagement have higher GPA and test scores [21] and are less likely to drop out [22], whereas students with low levels of cognitive engagement can have long-term issues, such as spoiling behaviours in class, absenteeism, and dropping out [23]. In view of the foregoing, therefore, it is pertinent to find out if cognitive engagement significantly predicts students' learning outcome directly or indirectly through the academic self-efficacy pathways.

2. METHODOLOGY

2.1 Design

Correlational research design was used. The correlational research design was used to determine relationships among two or more variables and to explore their implications for cause and effect [24].

2.2 Participants

The research sample was made up of 380 senior secondary school students from the three senatorial districts of Kaduna state, Nigeria comprising of 197 [51.8%] male and 183 [48.2%] female students. The participants were drawn from SS1 through proportional sampling method. The average age of the participants was 15.84±2.56.

2.3 Outcome Measure

2.3.1 Cognitive engagement scale

Cognitive Engagement Scale is a standardized instrument developed by Greene and Miller's [25], which was adopted and used to measure students' cognitive engagement. The questionnaire consists of 36 items. It is divided into subscales and this study used deep cognitive strategy, shallow cognitive strategy and persistence. Greener et al. [26] found an overall Cronbach alpha of.77.

2.3.2 Students self-efficacy scale

A standardized Student Self-Efficacy Scale developed by Morgan and Jinks [27], was used to measure student's self-efficacy, a belief that might relate to school success. A version of the scale consisting of 30 items was used in this study. Respondents were asked to indicate by ticking a particular number [28,2,6,29,12] indicating the extent they agree or disagree with each of the statements. The respondent total score was computed by summing up these scores. The instrument has an overall test-retest reliability coefficient of 0.82 [27].

2.3.3 Students learning outcome

To determine students learning the outcome, the researcher used the scores of terminal examination of the secondary school students (SS1). The subject scores were Mathematics, English, and Biology. Scores in the three subjects were summed up and divided by 3 to get student's average learning outcome.

2.4 Data Collection

The instruments were administered to the subjects on days approved by the school authorities for the exercise. The investigator was assisted by school teachers in the administration and collection of the instruments. Generally, data collection lasted for three weeks. All the three hundred and eighty questionnaires distributed were properly filled in, returned and considered useful for research purpose.

2.5 Data Analysis

All data analyses were performed using LISREL version 9.30. [30]. A P value < 0.05 was considered statistically significant. Continuous variables are shown as Mean±SD and Pearson's correlation coefficient was used to examine the zero-order relationship among Cognitive Engagement, academic self-efficacy and students' learning outcome. To examine the comprehensive relationship between studied variables, a path model was fitted.

To test the adequacy of the hypothesized model, the chi-square test was used to determine the model-fit. A no significant p-value represents a good model fit. Four other goodness-of-fit indices were also used: the Comparative Fit Index (CFI), Goodness of Fit Index (GFI), the Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). For the model to fit, the CFI, GFI and TLI should be above 0.95, and the RMSEA preferably lower than 0.05 [31,32]. In this study, the interrelationships of the different variables in the model were expressed in terms of standardized regression weights. The regression weights represent the strength of a relationship while taking into account the other relationships supposed in the model. The regression weights' interpretation is, for each point increase in the z-score of the determining variable, the outcome variable will increase or decrease by the standardized regression weight.

3. RESULTS

Table 1 shows zero-order correlation among variables entered into the path model. It shows significant zero-order correlation between deep cognitive processing and academic self-efficacy, $r = .400$, $p < .001$, and deep cognitive processing and learning outcome, $r = .454$, $p < .001$. Findings also revealed significant correlation between persistence and academic self-efficacy, $r = .436$, $p < .001$, and persistence and learning outcome, $r = .211$, $p < .001$. Furthermore, academic self-efficacy correlate significantly with learning outcome, $r = .564$, $p < .001$.

Structure equation model was carried out [30] to assess how well the model fits the data. Fig. 1 shows the path coefficients for the suggested relationships among the variables in the model while, table 2 shows the goodness of fit indices. Based on the fit indices, the hypothesized model fit the data quite well, $\chi^2(1) = 1.738$, $p = 0.187$, indicating that the observed and model-implied correlation matrices were not significantly different. GFI, CFI and TLI indices reached optimal levels ≥.95 at .99, .99 and .98, respectively. Finally, the RMSEA value for the present model was .044 (.000-.152), clearly falling within optimal levels ≤.05.

Table 1. Input data (zero-order correlation, mean and standard deviation) for analysis of a recursive path model of relationship among cognitive engagement, academic self-efficacy and learning outcome

Variable	1	2	3	4	5	M/SD
1. DCP	1					18.73±4.05
2. SCP	.274**	1				9.38±3.31
3. PS	.238**	.471**	1			24.15±5.25
4. ASS	.400**	.286**	.436**	1		82.39±12.92
5. LO	.454**	.184**	.211**	.564**	1	44.09±4.76

*Note: DCP=Deep cognitive processing; SCP= Shallow cognitive processing; PS=Persistence; ASS= Academic self-efficacy scale; LO=Learning outcome; M=Mean; SD=Standard deviation; **=p < .01*

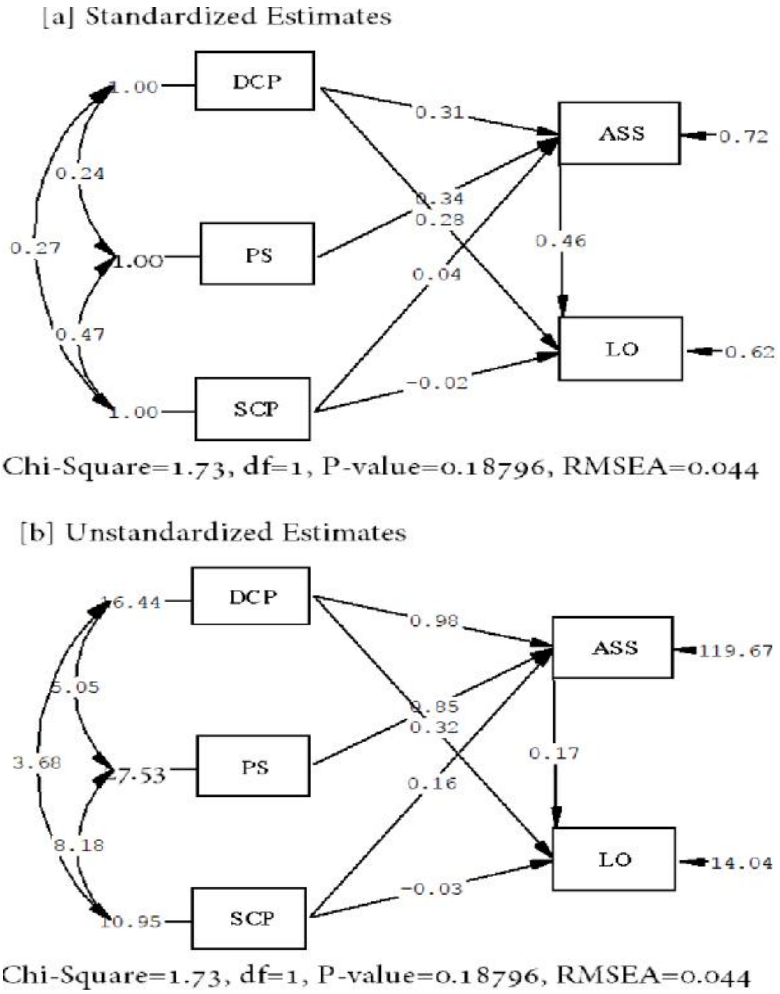

Fig. 1. A recursive path model of standardized relationship among cognitive engagement, academic self-efficacy, and learning outcome

Table 2. Value of selected goodness-of-fit indices for a recursive path model of the relationship among cognitive engagement, academic self-efficacy, and learning outcome

RMSEA (95% CI)	CFI	GFI	TLI	P	Df	χ^2
.044 (.000-.152)	.998	.998	.983	.187	1	1.738

Note: CI = Confidence Interval

Table 3. Regression coefficients for structural equations model showing direct, indirect and total effects

	Acad. Self-efficacy	Learning Outcome		
	Direct	Direct	Indirect	Total
DCP	.307	.276	.141	.418
SCP	.040	-.024	.018	-.006
PS	.344	.000	.158	.158
ASS	.000	.460	-	.460

Note: DCP=Deep cognitive processing; SCP= Shallow cognitive processing; PS=Persistence; ASS= Academic self-efficacy scale; LO=Learning outcome

The standardized regression weight that accompanies each arrow in the models (a and b) represents the strength of the direct and indirect relationship between the input variables. Table 3 shows direct, mediated and the total relationship between Cognitive Engagement, Academic Self-Efficacy and learning outcome. Findings reveal persistence directly predicts academic self-efficacy, (β = .344) implying that when persistence goes up by 1 standard deviation, Academic Self-efficacy goes up by 0.344 standard deviations. Persistence mediated by academic self-efficacy also significantly predicts learning outcome (β = .158). Results also show that academic self-efficacy goes up to .307 as deep cognitive processing increased by 1 standard deviation. Shallow cognitive processing poorly predicts academic self-efficacy (β = .040). Directly, deep cognitive processing predicts learning outcome (β = .276), indirect effect (β = .141). The standardized total (direct and indirect) effect of deep cognitive processing on learning outcome is .418. That is, due to both direct (unmediated) and indirect (mediated) effects of deep cognitive processing on learning outcome, when deep cognitive processing goes up by 1 standard deviation, learning outcome goes up by 0.418 standard deviations. As expected, academic Self-efficacy directly predicts learning outcome (β = .460) implying that a 1 standard deviation increase in Academic Self-efficacy, will increase learning outcome by 0.460 standard deviations. Shallow cognitive processing negatively predicts learning outcome (β = -.024) and this implies that a 1 standard deviation increase in shallow cognitive processing, will reduce learning outcome by -.024 standard deviations. It also poorly directly predicts learning outcome (β = .040).

4. DISCUSSION

The main objective of this study was to test the hypothesis that academic self-efficacy is related in a causal way to learning outcome in senior secondary school students. The hypothesized model tested showed good model-fit, meaning that the a-priori hypothesized relationships between the variables are acceptable. Deep cognitive processing was found to directly affect learning outcome. When combined with academic self-efficacy, learning outcome becomes largely affected. Self-efficacy was found to directly affect learning outcome but does better when combined with deep cognitive processing. Findings are consistent with research results [33,34]. In a structural equation modelling designed by Rotermunda [35], cognitive and behavioral engagement predicted learning success directly. The study by Wang and Holcombe [36] and Wang et al. [37] demonstrated that academic success is predicted by all sub-dimensions of student engagement, which include cognitive engagement.

In reviewing the literature, the researcher found several studies suggesting self-efficacy predicts academic performance and the two have a robust positive relationship [28,29,38,39,40,41,42,43,44,45]. A review of the literature confirms the findings of the research can be regarded as expected. Students' strong beliefs in their academic capacities result in enhanced academic performance. Additionally, self-efficacy is the strongest predictor when compared to other academic performance variance predicting variables. Significant relationships were found between self-efficacy and achievement among students. The study indicated that students' level of self-efficacy correlates with achievement.

5. CONCLUSION

Success in learning is to a large extent tied to the belief in one's ability. The use of deep cognitive strategies greatly enhances higher learning outcome via self-efficacy pathway. It appears also that persistence alone without self-efficacy

poorly predict learning outcome but does well via the self-efficacy pathway. Further study may be required in the similar sample to ascertain why persistence poorly predicts learning outcome directly after taking into account other variables in the model. However, generally, there is the need to encourage students to have a higher level of self-belief in their ability to succeed in school as well as an enabling cognitive process.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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