

COGNITIVE AND NON-COGNITIVE FACTORS ASSOCIATED WITH ACADEMIC PERFORMANCE AMONG NURSING ALUMNI IN TWO NIGERIAN NURSING SCHOOLS FROM 2010 TO 2020

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Abstract

This study aimed to examine the predictors of the academic performance of nursing Alumni from two Nigerian nursing schools between 2010 and 2020. We employed a quantitative retrospective design to examine the academic records of nursing Alumni at Ebonyi State School of Nursing Afikpo and Abia State School of Nursing Umuahia, located in southeast Nigeria. The research team used a sample size of 318 (159 from each school) selected through a systematic sampling technique from a pool of 1,540 Alumni records. Data were collected between June and August 2021 using a novel structured data extraction checklist. This study applied descriptive and inferential statistics to analyze the data at a significance level of 5%. The Alumni in the two examined schools exhibited significant differences in age ($p < 0.001$) and gender ($p = 0.009$). The Alumni with higher grades in Biology ($p = 0.005$), those who had given birth before ($p = 0.014$), and whose mothers held a non-biomedical job ($p = 0.014$) were more likely to achieve Credits in the Licensure examination in Abia. In Ebonyi, there was a significant association between pre-admission test scores and Licensure examination grade ($p = 0.001$). The findings of this study suggest that cognitive and non-cognitive variables significantly influence academic performance, and further studies are needed to confirm these results.

Keywords: Academic performance; Cognition; Nigeria; Nursing; Retrospective studies; Schools; School admission criteria.

Introduction

Approximately 40% of students fail to graduate within their stipulated time due to poor academic performance, contributing to the global shortage of nurses [1], [2]. As a result, educators worldwide assess students' academic performance as an indicator to prove the acquisition of a planned educational outcome [3], [4]. Despite the importance of cognitive elements in academic accomplishment, high intellect alone does not guarantee success, and individuals must be aware of their learning styles [5]. Learning styles are methods of learning that enable students to achieve, analyze, and internalize new knowledge [6]. Meaningful learning occurs when students integrate newly acquired information with their existing knowledge [7]. Therefore, scholars see a student's existing knowledge as a viable factor that predicts academic performance [8]. Nursing colleges globally strive to identify school entrance factors that can predict the academic performance of nursing students to improve the predictive quality of the student selection process [9].

Nurse educators are concerned about the student selection process for nursing programs [10]. The objective of selecting students from a general population of applicants is to identify individuals who will ultimately develop into effective nurse clinicians [11]. Researchers have been scrutinizing the admission criteria for nursing schools to determine their reliability in aiding the student selection process [12].

The admission criterion is a crucial factor that educationists believe could predict academic performance [13], [14]. Its main goal is to identify and select the best possible set of candidates that fits a specific program [15]. Existing literature suggests that admission criteria comprise cognitive and non-cognitive factors [14]. Cognitive factors include Secondary school certificate criterion subject grades and Admission aptitude test scores [16]. The non-cognitive factors include socio-demographic variables such as age, gender, and previous experience. The nursing admission process combines an applicant's secondary school academic performance, pre-admission aptitude test score and demographic background [12].

Secondary school academic performance has been used by nursing colleges as one of the decision tools for offering an applicant admission or not [7]. A minimum credit pass in the secondary school certificate examination is often required in specific subjects before an applicant is considered a prospective student [17]. Anglophone countries like Nigeria generally use five subjects (English, Mathematics, Physics, Chemistry, and Biology or Health

Science). The standardized pre-admission aptitude test assesses proficiency in the mentioned subjects [18].

Nurse educators introduced the pre- admission aptitude test into the student selection process to tap into the cognitive domains of prospective students [7]. Over the past decade, educational institutions have used pre-admission aptitude tests to complement academic attainment measured by secondary school certificates [18]. Some scholars argue that pre-admission aptitude tests assess the same constructs as secondary school certificate examinations and therefore do not provide additional predictive value beyond the metrics of secondary school certificates [7], [12]. To gain additional predictive value, researchers have focused on the demographic backgrounds of applicants [13].

Nurse educators and researchers consider demographic attributes, such as age, gender, marital status, parity status, and occupation of parents, in a bid to minimize student attrition from academic nursing programs [19]. However, the application of demographic background has been inconsistent and incoherent due to a lack of empirical evidence [10].

Previous empirical studies suggest a plausible association between academic performance, aptitude tests, and secondary school certificate grades [7], [14]. Additionally, there has been limited consideration of the association between demographic variables and nursing licensure grades in empirical studies. Therefore, further research is needed to enhance the understanding of this subject matter [18]. This study aims to fill the identified knowledge gap by comparing the predictors of academic performance among nursing Alumni from two Nigerian nursing schools between 2010 and 2020.

Researchers have emphasized the significance of investigating cognitive and non-cognitive factors that influence academic performance among nursing students [20]. Nursing educators can cultivate cognitive factors by understanding their role and focusing on them in nursing students [21]. Similarly, examining non-cognitive factors will enable nurse educators to address them and promote academic success among nursing students [22]. By analyzing data from 2010 to 2020, nurse educators can gain valuable insights into evolving trends, thus facilitating the development of tailored interventions. The focus on Nigerian nursing schools is crucial for understanding the unique context in which they operate. The high demand for qualified nurses in Nigeria further underscores the importance of identifying factors

associated with academic success, thereby improving nursing education and meeting healthcare workforce needs [23].

Methodology

Research Design

This study applied a retrospective design to review nursing Alumni academic records over eleven years (2010-2020).

Respondents

The research team conducted this study in the southeastern part of Nigeria, specifically focusing on two nursing schools: Ebonyi State School of Nursing Afikpo (ESSoN) and Abia State School of Nursing Umuahia (ASSoN). This study involved analyzing a total population of 1540 nursing alumni academic records from 2010 to 2020, with 759 records in ESSoN and 781 records in ASSoN. Using the Cohen formula with a statistical power of 0.84 [24], this study determined a sample size of 318 (159 records per school). The research team employed a systematic sampling technique to select a representative sample.

For ESSoN, this study determined the starting point by throwing a die, which resulted in 6. This study calculated the sampling interval by dividing 759 (total Alumni records) by 159 (required sample size), resulting in 5. Starting with the 6th academic record in 2010, the research team selected every 5th record until reaching 159.

For ASSoN, the research team threw a die to determine the starting point as 2. This study calculated the sampling interval by dividing 781 (total Alumni records) by 159 (required sample size), resulting in 5. Starting with the 2nd academic record in 2010, the research team selected every 5th Alumni record until reaching 159.

The inclusion criteria for the enrollment of Alumni records were as follows: filling in socio-demographic information and attempting the licensure examination between 2010 and 2020. This study excluded records of direct entry or transfer students.

Instrument

The research team designed an original (novel) structured data extraction form for data collection. The instrument had a total of 10 structured items. It had three sections (A-C). Section A (items 1-6) elucidated socio-demographic variables such as age, gender, marital

status, parity, and parents' occupation. Section B (items 7-8) tapped secondary school certificate subject grades in English, mathematics, physics, chemistry, and biology/health science. In addition, it extracted the aptitude test score grade. Section C (items 9-10) identified the licensure examination grade.

A panel of three independent nursing research experts reviewed the data collection form to ensure face and content validity. They examined the data collection form for conformity with variables of interest. All three experts scored each item dichotomously as relevant (score = 1) or not relevant (score = 0). On analysis of the data generated from the panel of experts, the agreement between the experts revealed a content validity index (CVI) of 0.89, and the form was considered valid²⁵. The research team submitted the final version of the data collection form to two bio-statisticians for suggestions in measurement categorizations on the instrument with possible statistical use and interpretation in perspective. The research team revised the data collection form based on recommendations from the experts.

Ethical Approval

The Lincoln University College IRB approved this study on 8 November 2021 (KPT/JPS-PA-10519). The research team collected data between 15 November 2021 and 31 January 2022.

Data Collection

The research team scrutinized the systematically selected nursing Alumni academic records to ensure the completeness of relevant data. The team extracted data on the following variables: socio-demographic, secondary school certificate grades, pre-admission aptitude test scores, and licensure examination grades (academic performance).

Data Analysis

This study collected categorical and ordinal data using the data collection form. It summarized the collected data using descriptive statistical tools such as frequency and percentage. It tested statistical association using the Fisher exact test, Chi-square, and Kendall-tau-B statistics. This study tested all hypotheses at a 5% level of significance. The research team performed all statistical analysis using Statistical Products and Service Solutions (SPSS) 21 software.

The scoring systems for secondary school certificates and nursing academic performance differ in their criteria. For secondary school certificates, scoring ranges from Alpha (70-100%), Beta (60-69%), Credit (50-59%), and Fail (<50%). In contrast, nursing academic performance scoring includes Alpha (90-100%), Credit (80-89%), Pass (50-79%), and Fail (<50%). The distinction reflects the higher standards and narrower grading ranges within the nursing academic performance scoring system. It highlights the emphasis on achieving excellence and competence in nursing education, as reflected by the higher cutoffs for satisfactory performance.

Results

Table 1 presents a summary of the socio-demographic variables of the study respondents and indicates significant differences in gender ($p = 0.009$) and age ($p < 0.001$) between Alumni in ESSoN and ASSoN. In ESSoN, the age group of 18-24 years accounted for more than half (56.6%) of the Alumni, with the majority being females (86.8%). In ASSoN, most Alumni were 18-24 years old (82.4%) and females (95.0%).

Table 1: Socio-demographic characteristics of the nursing school alumni

Variables	ESSoN (n = 159) f(%)	ASSoN (n = 159) f(%)	Fisher	<i>p</i>
Age (in years)				
18-24	90(56.6)	131(82.4)	24.94	<0.001*
25-31	69(43.4)	28(17.6)		
Gender				
Masculine (Male)	21(13.2)	8(5.0)	6.41	0.009*
Feminine (Female)	138(86.8)	151(95.0)		
Marital status				
Single	13.8(86.8)	135(84.9)	0.23	0.374
Married	21(13.2)	24(15.1)		
Parity status				
Nulliparous	147(92.5)	149(93.7)	0.19	0.413
Parous	12(7.5)	10(6.3)		
Mothers' occupation				
Non-biomedical	147(92.5)	144(90.6)	0.36	0.344
Biomedical	12(7.5)	15(9.4)		
Fathers' occupation				
Non-biomedical	148(93.1)	146(91.8)	0.18	0.416
Biomedical	11(6.9)	13(8.2)		

Ebonyi State School of Nursing Afikpo (ESSoN) and Abia State School of Nursing Umuahia (ASSoN). $p < 0.05$ = significant, SSon = State school of Nursing, * flags significant association

Table 2 demonstrates a significant association between secondary school certificate grades in Biology and licensure examination scores in ASSoN. The Alumni who obtained Alpha grades in Biology had a higher likelihood of scoring credits (80-89%) in nursing licensure examinations ($p = 0.005$). In ESSoN, this study observed no significant association between the variables.

Table 2: Association between secondary certificate grade and licensure examination grade

Variables	Academic Performance			<i>tau B</i>	<i>p</i>
	Credit (80-89%)	Pass (50-79%)	Fail (0-49%)		
ESSoN (n = 159)					
English				0.10	0.155
Alpha	2	4	0		
Beta	29	37	5		
Credit	27	43	12		
Mathematics				0.08	0.277
Alpha	2	1	0		
Beta	30	38	8		
Credit	26	45	9		
Physics				0.02	0.806
Alpha	1	4	0		
Beta	23	34	5		
Credit	34	46	12		
Chemistry				0.12	0.104
Alpha	2	4	0		
Beta	35	39	8		
Credit	21	41	9		
Biology				0.55	0.456
Alpha	0	6	1		
Beta	33	36	6		
Credit	25	42	10		
ASSoN (n = 159)					
English				0.07	0.349
Alpha	2	1	1		
Beta	37	26	10		
Credit	32	41	9		
Mathematics				0.02	0.761
Alpha	3	2	2		
Beta	37	31	12		
Credit	31	35	6		
Physics				0.08	0.278
Alpha	2	3	0		
Beta	41	30	11		
Credit	28	35	9		

Chemistry				0.01	0.883
Alpha	3	1	1		
Beta	31	35	7		
Credit	37	32	12		
Biology				0.20	0.005*
Alpha	6	0	0		
Beta	39	32	8		
Credit	26	36	12		

Ebonyi State School of Nursing Afikpo (ESSoN) and Abia State School of Nursing Umuahia (ASSoN). $p < 0.05$ = significant, $tau B$ = Kendall tau B statistic, * flags significant association

Table 3 revealed a significant association between pre- admission test scores and Licensure examination grades. The Alumni who had credits (70-89%) were more likely to make credits (80-89%) in the nursing licensure examinations ($p < 0.001$) in ESSoN but not in ASSoN.

Table 3: Association between pre-admission test score and licensure examination grade

Variables	Academic Performance			$tau B$	p
	Credit (80-89%)	Pass (50-79%)	Fail (0-49%)		
ESSoN (n = 159)					
Preadmission test				0.26	<0.001*
Credit	40	30	7		
Pass	18	54	10		
ASSoN (n = 159)					
Preadmission test				-0.01	0.912
Credit	38	34	12		
Pass	33	34	8		

Ebonyi State School of Nursing Afikpo (ESSoN) and Abia State School of Nursing Umuahia (ASSoN). $p < 0.05$ = significant, * flags significant associations

Table 4 revealed a significant association between Parity status and nursing licensure examination grade, such that Alumni who had given birth before (parous) were more likely to make credits in the licensure examination ($p = 0.014$) in ASSoN. Additionally, there was a significant association between mothers' occupations and nursing licensure examination grades, such that Alumni whose mothers had non-biomedical jobs were more likely to make credits in the licensure examination ($p = 0.014$). Nonetheless, the associations were not significant in ESSoN.

Table 4: Association between sociodemographic variables and licensure examination grade

Variables	Academic Performance			<i>tau B</i>	<i>p</i>
	Credit (80-89%)	Pass (50-79%)	Fail (0-49%)		
ESSoN (n = 159)					
Age (in years)				0.01	0.866
18-24	33	48	9		
25-31	25	36	8		
Gender				0.13	0.089
Masculine (Male)	11	9	1		
Feminine (Female)	47	75	16		
Marital status				0.12	0.120
Single	53	72	13		
Married	5	12	4		
Parity status				-0.00	0.958
Nulliparous	53	79	15		
Parous	5	5	2		
Mothers' occupation				-0.03	0.669
Non-biomedical	53	78	16		
Biomedical	5	6	1		
Fathers' occupation				-0.08	0.279
Non-biomedical	53	78	17		
Biomedical	5	6	0		
ASSoN (n = 159)					
Age (in years)					
18-24	56	57	18	-0.09	0.216
25-31	15	11	2		
Gender				0.04	0.686
Masculine (Male)	5	1	2		
Feminine (Female)	66	67	18		
Marital status				0.03	0.741
Single	60	60	15		
Married	11	8	5		
Parity status				-0.18	0.014*
Nulliparous	63	66	20		
Parous	8	2	0		
Mothers' occupation				0.216	0.014*
Non-biomedical	68	62	14		
Biomedical	3	6	6		
Fathers' occupation				0.04	0.621

Non-biomedical	66	62	18		
Biomedical	5	6	2		

Ebonyi State School of Nursing Afikpo (ESSoN) and Abia State School of Nursing Umuahia (ASSoN). $p < 0.05 = \text{significant}$, * flags significant association

Discussion

The findings of this study revealed that Alumni who achieved an Alpha grade in Biology had a higher likelihood of scoring credits (80-89%) in nursing licensure examinations ($p = 0.005$). The reason for the presence of this association in one school but not the other remains unclear. One possible explanation could be the effectiveness of the teaching-learning process in establishing an educational connection between previous biology experience and current nursing knowledge within each school. Since different teachers prepare students for licensure examinations, variations in teacher personalities and their ability to bridge the gap between current nursing knowledge and prior biology experience may contribute to these differences. These findings did not fully support the results of Liu et al. [16] in Korea, who found that including mathematics and English alongside sciences in student selection strongly predicted early nursing school performance ($p < 0.001$). The disparity in findings is not surprising due to the differences in educational syllabus and curriculum between Korea and Nigeria. Korea follows a syllabus adapted from the USA, while Nigeria maintains a syllabus adapted from the UK. In contrast, Wambuguh et al. [29] found that students with secondary school certificate grades of Credit or above (GPA = 3.0-3.7) inclusive of Biology, Chemistry, Physics, Mathematics, and English had 11% greater odds of passing the NCLEX-RN nursing licensing examination ($p < 0.010$). The discrepancy in findings was explainable since Wambuguh et al. considered GPA grade classification during the test of the associations, while this study considered percentage grade instead.

This study observed that nursing Alumni who obtained credits in the pre-admission test had a higher likelihood of achieving Credits in the nursing licensure examinations ($p < 0.001$). The reason for the significant relationship between these factors in one nursing school but not the other remains unclear. Differences in the distribution of test questions used in the pre-admission examinations explain the variation between the schools. These findings align with Plouffe et al. [24] which demonstrated that a higher pre-admission exam score was associated with improved quantitative academic performance ($p = 0.001$). The similarity in findings can be attributed to the similar retrospective design of both studies, relying on Alumni records. This study supports Al-Alwan et al. [27], a pivotal study that reported a significant association between pre-admission exam scores and quantitative academic performance ($p =$

0.01). The consistency in findings is likely due to the study's design and the Chi-square non-parametric data analysis methods used to examine the association between pre-admission test scores and quantitative academic performance.

This study found that Alumni who had previously given birth had a significantly higher likelihood of achieving Credits on the licensure examination ($p = 0.014$). This study observed a significant association between mothers' occupations and nursing licensing examination scores, with Alumni whose mothers worked in non-biomedical fields being more likely to pass the licensing exams ($p = 0.014$). However, this study found no statistically significant association between socio-demographic characteristics such as age, gender, marital status, and fathers' occupations with quantitative academic performance in the two examined schools. These findings align with Alshanmari et al. [28], who also found no significant relationship between age and quantitative academic performance ($p > 0.05$). The use of probability sampling explains the similarity in findings in both studies. This study and Alshanmari et al. utilized probability-based sampling techniques, which ensured an equal chance of selecting members from the target population. Probability sampling reduces the likelihood of accepting the alternative hypothesis when the null hypothesis is true. The possible reason for this finding could be the variation in human mental performance and intelligence quotient regardless of chronological age. This finding corroborates Yousafzai and Jamil, who reported that age was not a significant predictor of qualitative academic performance ($p > 0.05$). The similarity in findings could be due to the design utilized in the study. Both this study and Yousafzai and Jamil [14] were retrospective studies.

This finding does not support Lancia et al. [9] who found that female gender was associated with licensure examination grade ($p = 0.001$). The difference in sample size between the studies explains the discrepancy in findings. Lancia et al. examined 2,278 Alumni records, while this study examined 318. A larger sample size would have yielded similar results to Lancia et al. Furthermore, this finding is consistent with Plouffe et al. [26], who found that gender had no predictive value on quantitative examination performance. The similarity in results may be attributed to the characteristics of the subjects included in both studies, as they focused on nursing-related Alumni records. This finding is so because the intelligence quotient is determined not by biological sex but by practice and nurture. This finding corroborates Yousafzai and Jamil, who reported that age was not a significant predictor of qualitative academic performance ($p > 0.05$). The similarity in findings could be due to the

design utilized in the study. This study and Yousafzai and Jamil [14] were retrospective studies.

Contrasting results were evident across the two examined schools in this study regarding the association between parity status and quantitative academic performance. Therefore, the discrepancy in findings could be a matter of coincidence. This finding also did not agree with Al-Alwan et al. [27], which found no significant relationship between parity and quantitative academic performance. It was impossible to logically compare the findings of this study on the influence of parental occupation on students' quantitative academic performance since the currently available studies published within the past ten years were unable to examine the variables [14], [18], [29].

Limitations

The limitations of this study include the design and the scope. A retrospective research design used in this study has poor control of intervening and extraneous variables. It can not confidently establish cause-effect relationships. An experimental design should have been the ideal design for this study. Given that Nigeria is a large country with hundreds of nursing schools with varied environmental and teacher personality moderators, the findings of this study can not be generalized outside this study population.

Conclusion

Academic performance in nursing programs could be significantly predicted in part by Cognitive (Secondary school certificate grade in biology and pre-admission test score) and non-cognitive (Parity status and maternal occupation) factors. The research team recommends more studies to confirm the findings of this study. The results of this study would imply that admission selection criteria for nursing programs may need to make more consideration to favor fresh students who may have a combination of the following factors: Having (1) a higher grade in secondary school biology subject, (2) higher pre-admission test score, (3) given birth before, and (4) applicant having a mother in the non-biomedical field.

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