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Academic Self-Efficacy and Academic Achievement of Secondary School Physics Students: The Mediating Role of Academic Motivation.

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ABSTRACT

The study investigated academic self-efficacy and academic achievement of secondary school physics students: the mediating role of academic motivation in Agbani Education Zone of Enugu State. Four null hypotheses tested at .05 level of significance guided the study. Ex-post-facto and correlational survey research designs were adopted for the study. The population of the study comprised of 2,752 SS II Physics students in the Zone. Simple random sampling procedure was used in selecting 220 SS II Physics students comprising 115 males and 105 females from twelve selected schools in the Zone. Physics Academic Self-efficacy Scale (PASS) adapted from Abdul Gafoor and Muhammed (2006), Physics Academic Motivation Scale (PAMS) adapted from Sinan (2018) and Students' Achievement Scores obtained from their promotion examination results from the schools used were used for data collection. The adapted instruments (PASS) and (PAMS) were validated by three experts and tested for internal consistency reliability using Cronbach's alpha with the reliability indices of 0.82 and 0.86 for PASS and PAMS respectively. Data were analyzed using path analysis to test the proposed hypotheses. The findings of the study amongst others showed that academic motivation positively mediated the relationship between academic self-efficacy and academic achievement of secondary school physics students. Based on these findings, it was recommended that teachers should adopt teaching strategies that would stimulate students' academic self-efficacy through their academic motivation in teaching Physics.

Keywords: Physics, Academic self-efficacy, Academic motivation and Academic achievement.

INTRODUCTION

Physics is a fundamental knowledge that underlines the physical universe which directly influences people's daily activities. Physics is one of the core science subject taught in Nigerian senior secondary schools. Physics is a science subject that studies matter, objects, energy and their interaction in a given system or environment (Onah & Anamezie, 2022). Physics is the most fundamental and the root of every field of science (Eryilmaz, 2016). Anyakoha (2016) defined physics as a natural science that involves the study of matter and energy and their interactions. Onah (2022) defined physics as the study of natural phenomena at its most fundamental levels and manner. This is because, physics, being one of the core subjects offered in Nigerian schools forms the basis for the nation's technological advancement and human resource development (Abubakar, 2012). Physics knowledge has contributed immensely to the production of tools and devices of tremendous advantage to the human race (Sani, 2012). The knowledge of physics according to Gabriel (2012) offers the learners the opportunity to think critically, reason analytically and acquire the spirit of enquiry. The researcher also stressed that the knowledge of physics develop in students, the scientific and technological knowledge, skills and

attitudes which will assist them to make decisions based on the observation and experimentation. The discovery in Physics led to the discoveries of valuable devices like computers, lasers, transistors etc. these devices are paramount to the development of technological science.

Despite the positivism of physics to humanity, students' academic achievement in the subject at senior secondary school and institution of higher learning has been too abysmal. In Nigeria, there has been a recurring unacceptable achievement of students in physics. Record of students' achievement at Senior School Certificate Examination (SSCE) in physics conducted by West African Examination Council (WAEC) according to Adolphous (2018) in Onah (2022), shows that between 2001 and 2009 (except in 2006), less than 50% of the students who enrolled for physics obtained credit level pass and above to secure admission into the university in order to pursue courses that require physics. Adolphous also stressed that the failure rate continued from 2007 to 2009 (42.9%, 47.1% and 46.2%) and in 2013 (46%) with an improved achievement in 2010, 2011 and 2012 (50.2%, 62.6% and 67.2%). According to Onah and Achufusi (2022) the failure trends continued in 2015, 2017; and 2020 (47.83%, 41% & 36% respectively) with an improved achievement in 2016, 2018; and 2019 (71%, 87% & 80% respectively). In general, this cannot be considered an acceptable achievement as many have lamented that achievement of Nigeria students in physics at the Senior School Certificate Examination (SSCE) has been generally not so good (Adaramola & Obomanu, 2011). Even the WEAC chief examiners report that this poor achievement of the students' could be linked to their lack of self-efficacy and motivation in the subject. They suggested as well that teachers should teach students to enhance their intrinsic, extrinsic and amotivation; also in their recommendation is the students' self-efficacy to be improved as they are capable of increasing students' academic achievement in physics. According to Isna and Mita, (2022) who observed that students' self-efficacy negatively influence academic procrastination when observing the mediating influence of academic motivation.

The students' poor achievement in physics in particular and sciences, in general, have been attributed to many factors. These include; poor methods of physics instruction by the teachers, insufficient number of qualified physics teachers, lack of indigenous textbooks, inadequate apparatus in the physics laboratory, poor classroom management by physics teachers, teacher's belief and attitude towards physics, physics teacher's inability to improvise, inadequate instructional materials and aids, educational background and parental expectations on the learners and finally students' related factors or variables like students' academic anxiety, academic self-efficacy, academic locus of control, academic motivation and more (Adedayo & Jegede, 2013 pg 80-83). This study therefore, is set to find out the mediating influence of academic motivation on academic self-efficacy and academic achievement of secondary school Physics students'.

Academic self-efficacy is ones belief and ability to organize and execute the course of action that is required to produce desired goal. Students' belief about his thinking in relation to academic is the key to what he can achieve. Academic self-efficacy is the students' conviction that he can successfully perform a given task assigned to him for the purpose of achieving a goal. According to Putwain, Sander and Larkin (2013), self-efficacy is the belief in one's ability to perform desired actions. Individuals' actions are influenced by their views of their abilities and the results of their efforts, and

self-efficacy refers to their belief in their ability to learn or perform well (Ugwuanyi, Okeke & Asomugha, 2020). Bandura (1997) describes three dimensions of self-efficacy; as thus: magnitude, generality, and strength. The magnitude dimension relates to the difficulties in the task being done so that the students choose tasks based on the difficulty level of the task. The generality dimension is more related to the field of work or individual beliefs in carrying out their duties and the expectations to success in certain situations can be generalized in other situations. The strength dimension relates to the strength or weakness of the students' beliefs or refers to a certain assessment of how someone can be successful at a particular task. Previous research by Ugwuanyi, Okeke, and Ageda (2020), found a significant positive association between self-efficacy and learner performance, while Odiri (2020) discovered a significant relationship between students' self-efficacy and mathematics achievement. The difference in results found in research conducted by Sari (2016), revealed that academic self-efficacy is not a good predictor of academic procrastination. Apart from self-efficacy, academic motivation is a significant and positive predictor of academic achievement (Mamah, Nnadi & Iwuagwu, 2021).

Academic motivation is an innate drive to work towards a goal oriented project. Academic motivation directs students' action towards learning a particular behaviour in order to achieve higher desired academic goal. Academic motivation is an important concept in classroom teaching and learning of physics and it is linked to increased levels of academic achievement (Ajayi, Lawani & Salomi, 2012). A student who is academically motivated is seen as self-determined to succeed in academic work and has the urge to achieve, that is, the level of motivation varies from one student to another. Academic motivation means generating the energy needed for academic tasks (Bozanoglu, 2004). According to Eccles and Colleagues (1983) theory of expectancies of motivation. They explained that an individual's perception about whether he or she can successfully accomplish a task is dependent on the individual's ability belief and expectancies of success through an innate motivation. The National Association of School and Psychologists (2014) stated that positive academic motivation shows these characteristics; willing to learn, liking related learning activities and believing that education is important. Students who have high motivation will positively influence or affect academic self-efficacy of the student, meaning that the higher the intrinsic motivation in an individual, the higher the tendency for self-efficacy behavior (Onah, 2023). Deci and Ryan (2000) explained that there are three dimensions of academic motivation which include extrinsic motivation, intrinsic motivation and amotivation. The extrinsic motivation dimension is defined as a behavior that is based on certain consequences, for example: external rewards, social acceptance, running from punishment and obtaining certain achievements. The dimension of intrinsic motivation is based on individual behavior that is carried out for self-satisfaction rather than separate consequences from the individual. The amotivation dimension is the absence of motivation in a person. Individuals who are amotivated do not have will to carry out any activity within them. For example, a student who is highly motivated to do homework out of curiosity and interest is said to be intrinsically motivated while another student who is motivated to do homework to procure the approval of the teacher or parent is said to be extrinsically motivated. There is another student who may not value the homework or feels incompetent to do it and lacks an intention to act. This student is said to be amotivated.

Based on the problem of the study, which anchored on students' poor achievement in physics as evident with the empirical evidences; there is complete dearth of the efficacy of academic self-efficacy and academic motivation in Agbani Education Zone. Therefore, the trust of the study is to investigate academic self-efficacy and academic achievement of secondary school physics students: the mediating role of academic motivation. The main purpose of this study was to figure out the effect of Academic Self-efficacy on Academic achievement of secondary school physics students through Academic Motivation.

The following null hypotheses were proposed for the study, which was tested at .05 level of significance.

1. Academic Self-Efficacy has a no significant effect on Academic Motivation.
2. Academic Motivation has no significant effect on Academic Achievement.
3. Academic Self-Efficacy has no significant effect on Academic Achievement.
4. Academic Motivation does not mediate the relationships between Academic Self-Efficacy and Academic Achievement of secondary school physics students.

Conceptual Model

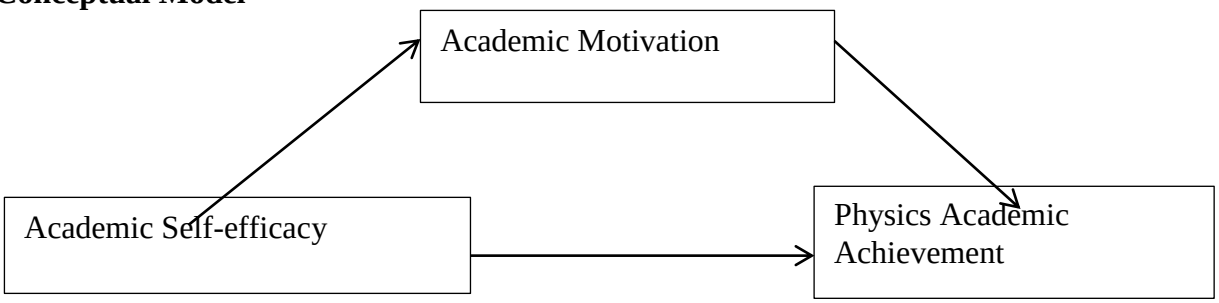

Figure 1.

Previous studies (Luthans & Youssef-Morgan, 2017; Diseth, 2011; Ajmal & Rafique, 2018) have shown that students' with higher academic self-efficacy could likely employ cognitive strategies while learning to achieve high grades and perform difficult tasks. From the foregoing, the researcher might expect that students' academic self-efficacy can directly affect academic achievement of secondary school physics students and may indirectly affect academic achievement through academic motivation. The proposed hypotheses above follows the extant of the literature reviewed in the present study. Students' academic self-efficacy would predict students' academic achievement. This is to say that student with higher academic self-efficacy might graduate or produce higher academic achievement and grades. The students' academic self-efficacy would predict academic motivation. This to say that students' with higher positive academic motivation could positively associate with their teachers' ability to expose them with high level of cognitive construct in order to make good grades. Again, this study proposed that students with high academic motivation may likely show higher academic achievement. Academic motivation would mediate the relationship between students' academic self-efficacy and their academic achievement.

Method

The study employed an ex-post-facto research design incorporating both the correlation and qualitative approaches to interpret the results of the test of null hypothesis. The ex-post facto research

design was chosen because the condition of the (independent variables) learners and the results had already occurred as is expected in such designs that you do not have to manipulate any independent variable (Orodho, 2012). The correlational strand enabled the researcher to determine the relationship between variables through the use of correlational statistics (Wenslaus, 2015). Orodho (2012) notes that in a correlational research, relationships among two or more variables are studied without any attempt to influence them. Orodho (2012) and Brooks (2013) contend that a major purpose of ex-post-facto research design of a correlation subtype is to clarify an understanding of important variables that have already occurred through the identification of relationships among the variables. The study was carried out in Agbani Education Zone, located East of Enugu State, Nigeria. Enugu State has six Education Zones which include: Enugu, Awgu, Agbani, Nsukka, Obollo-Afor and Udi. Agbani Education Zone consists of three local government areas; namely: Enugu South, Nkanu East and Nkanu West local government area. The area has the first indigenous tertiary institution of the state which is Enugu State University of Science and Technology, Agbani (ESUT). The area is predominantly semi-urban in nature with basic amenities such as good roads, hospitals, electricity, schools and markets. Most people living in the zone were civil servants, students, traders and many farmers. The researcher chose Agbani Education Zone due to the fact that most of the secondary schools have qualified physics teachers, laboratories and instructional materials and yet students experience difficulties in answering questions in physics in their external examinations which was evident in their final achievement scores and grades in WAEC results hence the need for the study in the area. Therefore, this research will help the teachers to integrate academic self-efficacy and academic motivation which will in turn enhance good academic achievement. The population for the study was 2,752 SS2 Physics students from 44 public secondary schools in the zone. Two hundred and twenty (220) SS2 physics students (115 males & 105 females) drawn through multi-stage random sampling procedure from twelve secondary schools in Zone.

In stage one, simple random sampling technique (precisely by balloting) was used to select Enugu South Local Government Areas. In second stage, purposive sampling was used to select twelve secondary schools in the local government area based on the existence in those schools of well-equipped physics laboratories and experienced physics teachers with teaching qualification. Simple random sampling technique (precisely balloting) was next used to select 220 students.

The instruments used for data collection was the Abdul Gafoor and Muhammed (2006) academic self-efficacy scales, Sinan (2018) academic motivation scales modified by the researchers and students' achievement scores retrieved from their school records through their form teachers were used for data collection. Originally, the self-efficacy scales are for students' general self-efficacy and academic motivation scales for technology but was modified to specifically physics ability belief and expectancies of goal.

The instrument Physics Academic Self-efficacy Scale (PASS) and Physics Academic Motivation Scales (PAMS) were face validated by three experts from Enugu State University of Science and Technology (ESUT) and tested for reliability using Cronbach alpha which yielded a coefficient of 0.82 and 0.86 indices respectively. Physics academic Achievement scores were extracted from the students' promotional

examination of 2021/2022 academic session. This is because Enugu state government conducted a unified examination across the state secondary schools for promotion course. The variable of academic achievement is an interval scale. A student's achievement score is lower or higher than another. The instrument was distributed to the respondents upon selection through the help of the research assistants who doubled to be their physics teachers in their respective schools. This method enabled the researchers to have 100% return of the filled instruments. The proposed hypotheses, a path analysis in AMOS version 22 was employed, and all estimates were calculated using the maximum likelihood with bootstrapping (5000 resampling at 95% bias-corrected confidence intervals (CI95%).

Results

Hypothesis 1: Academic Self-Efficacy has no significant effect on Academic Motivation.

Table 1: Summary of regression weights of the observed variables

Parameter	Estimates	S. E	C. R	P-value	Decision
MV ← IV	.659	.060	10.974	.000	S
DV ← MV	.634	.038	16.592	.000	S
DV ← IV	.149	.042	3.529	.000	S

Key:

← = The direction of prediction

IV = Independent Variable (Academic Self-efficacy)

DV = Dependent Variable (Academic Achievement)

MV = Mediation Variable (Academic Motivation)

Table 1 shows that the probability of getting a critical ratio as large as 10.974 in absolute value is less than 0.000. The result figured out that academic self-efficacy influences academic motivation positively and significantly (β= .659, t(220) = 10.974, P < 0.05[.000]). In other words, the null hypothesis is rejected. Thus: the regression weight for Self-efficacy in the prediction of Motivation is significantly different from zero at the 0.000 level (two-tailed).

Hypothesis 2:

Academic Motivation has no significant effect on Academic Achievement.

Table 1 shows that the probability of getting a critical ratio as large as 16.592 in absolute value is less than 0.000. The result figured out that academic motivation influences academic achievement positively and significantly (β= .634, t (220) = 16.592, P < 0.05[.000]).In other words, the null hypothesis is rejected. Thus: the regression weight for academic motivation in the prediction of Academic achievement is significantly different from zero at the 0.001 level (two-tailed).

Hypothesis 3: Academic Self-Efficacy has no significant effect on Academic Achievement.

Table 1 shows that the probability of getting a critical ratio as large as 3.529 in absolute

value is .000. The result figured out that academic self-efficacy influences academic achievement positively and significantly (β= .149, t (220) = 3.529, P < 0.05[. 000]). In other words, the null hypothesis is rejected. Thus: the regression weight for Academic Self-efficacy in the prediction of Academic achievement is significantly different from zero at the 0.001 level (two-tailed).

Hypothesis 4: Academic Motivation does not mediate the relationships between Academic Self-Efficacy and Academic Achievement of secondary school physics students.

Table 2: Summary of mediation analysis

Observable	Standardized Estimation	P –Value	Confidence Interval at 95.0% for β		Decision
			Lower bound	Upper bound	
Total effect	0.601	.004	.480	.667	Significant impact
Direct effect	0.158	.014	.049	.241	Significant impact
Indirect effect	0.443	.004	.349	.507	Significant impact

The results in Table 2 revealed that the total effect of academic self-efficacy on academic achievement was significant (HO4: β = .601, P < .05. with the inclusion of mediating variable (Academic motivation), the impact of self-efficacy and academic achievement became significant (β = .158, P < .05. the indirect effect of academic self-efficacy on academic achievement of secondary school physics students through academic motivation was found significant (β = .443, P < .05. This shows that the relationship between self-efficacy and academic achievement is partially mediated by academic motivation.

Discussion

The finding of the study showed that students' academic motivation partially mediates the role of students' academic self-efficacy and academic achievement of secondary school physics students in Agbani Education Zone. The study revealed that, academic motivation indirectly increases students' academic achievement scores and overall performance together with increased behaviour in performing academic tasks in learning activities. This indirect relationship is facilitated by strong academic motivation so that the tendency of student academic achievement is more/ increased.

Overall, academic achievement has the tendency and consequence of increasing performance, quality of students' life, positive influence in the society (becomes active, easily encouraged, gains of self-confidence and anxiety), (Zusya & Akmal, 2016). In this study, the academic achievement of secondary school physics students can be increased through students' academic self-efficacy and academic motivation. This finding is consistent with previous research by Ugwuanyi and Achufusi (2021) who found that students' self-efficacy is one of the highest predictors of students' academic achievement. Students who have high self-efficacy in their ability to demonstrate high level of commitment to their academic activities will tend to pay more attention to his/ her academic pursuits by doing his academic assignments (Sawi, 2015). Research conducted by Ugwuanyi, Okeke, and Ageda (2020) identified high students' academic self-efficacy as the results of higher self-esteem of the students. Higher achievement allows the students to have efficacy in their

abilities, lack fear of failure in carrying out tasks successfully. Students who scores higher in achievement tend to have self-esteem and attribute the success to the teacher's ability, confidence, and good working relation with other students together with serene atmosphere for studying.

In addition, academic motivation can be increased to increase academic achievement in students (Malkoç & Mutlu, 2018). This is in line with Cavusoglu & Karatas (2015) who showed that academic motivation is positively correlated with academic achievement. Students who have a high level of academic motivation make them focus and do their homework, assignment as at well due. They tend to integrate with other students, ask questions and pursue a target goal for good life attainment. It means that, when the level of motivation increases, the tendency to high achievement increases (Mamah, Nnadi & Iwuagwu, 2021). Galugu and Samsinar (2019) observed that positive teachers' self-concept on the students encourages student's high achievement, self-regulation and a high level of self-esteem. In this study, the direct effect of students' self-efficacy on academic achievement is smaller than the indirect effect, which is only 15.7%. Therefore, students' self-efficacy can no longer directly influence academic achievement when academic motivation is added as a mediator. This means that the self-efficacy effect is explained better by the presence of academic motivation, where the effect size increases from 15.7% to 46.6%. The finding of this study is in agreement with Izuchi, Bruno, and Onyekuru, (2017) who found that motivation significantly predicted academic achievement. This showed that the more students are being motivated, the better their academic achievement.

Finally, the findings of this study also showed the dissimilarity with the results of Sari's (2016) which explains that academic self-concept is not a good predictor of academic achievement. Furthermore, research conducted by Reza (2015) and Reyes, et al (2012) explained that there is no relationship between academic motivation and academic achievement.

Conclusion/ Recommendation

Academic motivation partially mediates the relationships between students' academic self-efficacy and academic achievement of secondary school physics students. The finding concludes that physics students' academic self-efficacy cannot directly increase student academic achievement without the role of academic motivation. The implication of this research is that it is important for teachers to increase the academic self-efficacy of their students in order to positively influence students' academic motivation to have confidence that they are capable to carry out certain tasks and assignments successfully. Then, students are expected to be able to increase their own academic motivation in order to be able to increase academic achievement. It was recommended that teachers should challenge the students with learning materials that will encourage them to develop self-efficacy through academic motivation. School authorities should engage the services of guidance and counselors that will help students to know how to improve their academic self-efficacy and motivation and apply them to achieve their learning needs. More so, Physics teachers should arrange learning activities in such a way that it will help students to be self-directed in their learning; which will help them apply all the motivation both extrinsic and intrinsic academic motivation in the learning of physics.

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