

Evaluating The Impact Of Teachers' Self-Efficacy On Students' Academic Achievement In Biology In Enugu State, Nigeria

Alphonsus U. Okoro¹, Chinwe R. Nwagbo², Christian S. Ugwuanyi^{3,4*} & Bernard E. Ugwu⁵

^{1,2,3}Department of Science Education, University of Nigeria, Nsukka.

⁴Faculty of Education, University of the Free State, Bloemfontein, South Africa.

⁵Department of Educational Foundations, University of Nigeria, Nsukka.

Abstract

Self-efficacy entails the belief that an individual has the ability to carry out certain actions that will result in the desired outcome. Teachers' self-efficacy is, therefore, the teachers' confidence in their ability to promote students' learning. This study examined the impact of teachers' self-efficacy on academic achievement in Biology among secondary school students in Enugu State using an ex-post facto research design. From a population of 5693 (2254 females and 3439 males) SS1 Biology students and 62 SS1 Biology teachers in all the 48 public senior secondary schools in Obollo A for Education Zone of Enugu state, a sample of 270 SS1 Biology students and 25 SS1 Biology teachers were selected through purposeful sampling technique. The instruments used for data collection were the Teachers' Self-Efficacy Index (TSEI), Biology Achievement Test (BAT) and Eysenck General Intelligence Test (EGIT). Three research questions were answered in the study while Analysis of covariance (ANCOVA) was used to test the three hypotheses that guided the study at 0.05 level significance. The results of the study found out that: students who were taught by teachers of high and moderate Teachers' self-efficacy levels had better academic achievement when compared with those students whose teachers exhibited low Teachers' self-efficacy; that male and female students did not show any significant difference in academic achievement in Biology based on teacher Teachers' self-efficacy behaviour. It was recommended that a favourable climate and conducive working atmosphere be put in place to ensure effective process of teaching and learning Biology using TSE.

Keywords: Self-efficacy, Achievement, Biology Teacher.

Introduction.

Most developing nations now make frantic efforts to improve on the study of science and other allied subjects in their schools in order to boost the development of science and technological skills among students. This is because the development of any nation depends largely on the quality of education received by the people. Proper education of the society guarantees rapid national development. The teacher is the center of any developmental process (Babalola, 2008). Teachers' task is to teach, educate, provide educational guidance, promote the quest for scientific and technological knowledge and conduct regular assessment (FRN, 2007). It is often said that high achievement of students depends upon effective teaching of their teachers.

The teacher is looked upon as a role model. He is one who by virtue of training and experience facilitates learning in students through appropriate pedagogy (Babalola, 2008; Ikedigwu, 2005) Teachers are generally presumed to have undergone approved professional training in education at appropriate levels capable of impacting knowledge, positive attitude and skills to learners. While it is believed that a teacher should facilitate learning and impact knowledge in their students through appropriate pedagogy, research studies have continued to report in the opposite. For instance, Okeke (2007) reported that majority of the biology teachers use ineffective approach in teaching biology. Also, Norom (2009) observed that many Nigerian secondary school teachers do not apply the recommended innovative science teaching methods for instructional delivery. Instead, it was noted that the biology classroom is still dominated by teacher-center, didactic teaching methods that do not promote higher order thinking and students' academic achievement.

Biology teachers should as a matter of fact, reflect on teaching practices as well as knowledge and pedagogy in an effort to enhance academic achievement in the subject. The task of creating learning environment conducive for effective teaching and learning of biology rests heavily on the talents and self-efficacy of the teachers (Karen, 2005). This is the belief that an individual has the ability to carry out certain actions that will result in a desired outcome. Self-efficacy could be defined as the personal belief of possessing the ability to perform professional tasks with mastery. Teachers' self-efficacy is, therefore, the teachers' confidence in their ability to promote students' learning (Protheroe, 2008; Klassen and Chiu, 2010). Self-efficacy of the teacher could affect his efforts in teaching, their identification of goals, their level of eagerness and their classroom behaviours.

Teachers with high sense of self-efficacy levels may be equipped with the zeal to teach and educate. They are open to novel ideas, and new methods and they use student centered-approaches in teaching (Gorozidis and Papaioannou, 2011, Koc, 2013), they support students' autonomy (Guvenc, 2010), are patients towards failure and criticize less when students make mistakes (Woolfolk, 2006). They provide extra support to low achieving students, create students perceptions regarding academic skills and identify available goals (Burke, 2005). They use more humanistic classroom management approaches (Savran-Gencer and Cakiroglu, 2007). On the other hand, teachers with low self-efficacy levels establish more rigid rules and provide control based on external rewards and punishment (Tschannen in Ozka, 2014). They are more authoritative

and have high levels of burnout (Bumen, 2010). On the contrary, teachers who possess stronger perceptions of self-efficacy tend to display specific observable behaviours for themselves such as efforts, persistence, enthusiasm and confidence. These teachers use teaching time differently and engage students in learning for a long period of time (Karen, 2005). These aspects of the teachers' attitude, to a large extent, influence students' achievement. That is why, perhaps, Adu Tadu and Eze (2012) reiterated that teachers' self-efficacy is important because it has a positive relationship with students' academic achievement.

The importance of teachers' self-efficacy notwithstanding, numerous research studies continue to report low self-efficacy among teachers. Dejaeghere, Williams and Kyeyune (2009) found out that head teachers had low self-efficiencies in leadership, management, and instructional supervision and community relations. Jumanne (2012) observed that teachers had average levels of self-efficacy towards teaching of science process skills. Similarly, Odongo (2011) and Oging, Muola and Nwanta (2014) added that teachers' self-efficacy in special needs and HIV and AIDS education were low and that the low teachers' self-efficacy negatively affected the curriculum implementation by teachers.

Differences in teachers' self-efficacy levels have also been attributed to teachers' gender characteristics. Aurah and MC Connell (2014) and Kinyua and Oboko (2013) found out that gender had statistically significant influence on teachers self-efficacy and has an influence on students' careers, aspirations and performance in examinations. Gender in the current study referred to the attitudes, feelings and behaviors associated with a person's biological sex (male or female). Bilali (2013) found out that female and male teachers had similar levels of self-efficacy indicating that there was no significant difference in the level of self-efficacy across gender. However, Klassen and Chiu (2010) reported that female teachers had lower self-efficacy in classroom management than their male counter parts. Certain variables have been accounted for the low level of teachers' self-efficiency. Zabarakar (2010) argued that in areas where self-efficacy is observed among the teachers the influence of leadership and professional development experiences play a role in their degree of self-efficacy

Nevertheless, teachers' self-efficacy may be increased through the influence of conducive working environment. Teachers who are comfortable with the positive working environment, who feel supported by adequate administrative climate tend to have high self-efficacy potential. In other words, supportive environment that is appropriate for biology teachers would by and large create their motivation, enthusiasm, enable them to engage their students in learning situations for better academic achievement.

Statement of the Problem

The task of creating the enabling learning environment for the acquisition of knowledge, skills and values of the society and specifically, for the development of science and technological skills among the students rests heavily on the talents and self-efficacy of the teachers which the biology

teacher lacks according to literature. This deficiency on the side of the biology teacher does not go down well in the effort to improve the academic achievement of students in biology viz-a-vis science and technology development in the country. Moreover, studies on teachers' self-efficacy have been carried out mainly in foreign countries with peculiar backgrounds. A study of this nature in the Nigerian context becomes imperative to determine the impact on students' academic achievement in biology, especially in secondary schools. Hence the statement of the problem posed as a question "what is the impact of teachers' self-efficacy on students' academic achievement in Biology in Nigeria?"

Method

An ex-post facto research design was adopted for this study. Nworgu et al. (2013), Benson et al. (2020), Ugwuanyi et al. (2020), Ugwuanyi et al. (2022) have adopted similar design. The study was conducted in Obollo Afor Education Zone of Enugu state, Nigeria. Obollo Afor education zone is geographically located in the northern part of Enugu state. It belongs to Enugu north senatorial zone and has three Local Government Areas: Igbo-Eze South, Igbo-Eze North and Udenu local government areas. The researcher's choice of the zone is based on consistent poor performance of students in Biology in the area. The population of the study consisted of all the fifty-seven (57) Senior Secondary One (SSI) Biology teachers and 5693 students (2254 males and 3439 females) in 42 co-educational public schools that have reached SS1 class in the zone for 2016/2017 session. Using stratified and purposive random sampling techniques two hundred and seventy (270) biology students (135 males and 135 females) from 10 public co-educational schools and twenty-five (25) biology teachers (14 males and 11 females) were selected. The ten (10) schools were selected using simple random sampling.

Three instruments that were used in this study include: Teacher Self Efficacy Index (TSEI), Biology Achievement Test (BAT) and Eysenck General Intelligence Test 4 (EGIT 4).

Teacher Self-Efficacy Index (TSEI)

Teacher Self Efficacy Index (TSEI), was developed to measure teacher Self Efficacy in Biology classrooms. TSEI has nine components for teacher self-efficacy which were operationalized in terms of teacher-student interaction. The nine components in the scale include: self- efficacy towards guiding groups; self- efficacy towards using tasks; self- efficacy towards using innovation; self- efficacy towards idea generation; self- efficacy towards idea promotion; self- efficacy towards idea realization; self- efficacy towards student engagement; self- efficacy towards instructional strategies; self- efficacy towards classroom management. . For each of the nine components, there are three statements/items that depict teacher behaviours consistent with each component.

Table 1

Teacher self efficacy index (TSEI)

Components of TSE	Sub scales/ items of TSE
-------------------	--------------------------

Self-efficacy towards guiding groups

1. Being able to help student on the right course.
2. Assess well what is going on when a group work is in progress.
3. Able to foster co-operation in a group when the pupils experience difficulties.

Self-efficacy towards using tasks

1. Able to find out the reason for students' unmotivated behaviour.
2. Able to give the necessary clues to pupils in searching for relevant information for a task.
3. Can make students think about finding solutions themselves.

Self-efficacy towards using innovations

1. Cope quite well with stress that attends the implementation of educational innovations, as for example the study-home.
2. Cope well with stress originating from innovative educational changes such as the study-home.
3. Able to persist on innovative projects despite skeptical comments from colleagues

Idea generation

1. Creating new ideas for difficult issues.
2. Searching out new working methods/techniques or instruments.
3. Generating original solutions for problems.

Idea promotion

1. Mobilizing support for innovative ideas.
2. Acquiring approval for innovative ideas.
3. Making important organizational members enthusiastic for innovative ideas.

Idea realization

1. Transforming innovative ideas into useful applications.
2. Introducing innovative ideas into the work environment in a systematic way.
3. Evaluating the utility of innovative ideas.

Student engagement

1. Ability to motivate students who show low interest in biology lessons
2. Ability to arouse the students to learn the skill well.

3. Emphasize rules, laws and generalities.

Instructional strategies.

1. Gauge students' comprehension of what was taught
2. Allow students to share their strong and weak views with one another
3. Encourage students to tryout what they had learnt.

Classroom management

1. Ability to control disruptive behaviour in class.
2. Counsel students who experience failure
3. Show students that their ideas and suggestions have value.

Any teacher that exhibits each of the self-efficacy behaviour scores one mark. The Teacher self efficacy index (TSEI) was pilot tested using SSI biology teachers drawn from the non co-educational schools. A reliability analysis yielded a sufficiently high Cronbach's Alpha coefficients for the subscales as follows: Self-efficacy towards guiding groups .64, Self-eficacy towards using tasks .67, Self-efficacy towards using innovations .77, Idea generation .62 Idea promotion , .69 Idea realization .57 Student engagement, .71 Instructional strategies.64 and Classroom management .75 and 0.93 for the whole test.

Biology Achievement Test (BAT)

This instrument was used to measure students' achievements in Biology. This is a 30 – item multiple-choice objective tests, measuring achievement in the following content areas: Photosynthesis, Mineral requirement of plants, Food substances in animals, Enzymes, and Modes of nutrition in plants and animals. The test items were selected from West African Examination Council (WAEC) past questions and the content scope taught in the lesson. From the list of topics and expected behavioural outcome, the researcher prepared a table of specification from where the items for BAT were generated. The items were developed to cover lower and higher order levels of the cognitive domain as contained in Blooms (1956) Taxonomy of Educational objectivities. Thus, the 30 items were weighted according to knowledge, comprehension, application, analysis, synthesis, and evaluation. The Biology Achievement Test (BAT) was trial tested to establish content and face validity using SSI biology students in the schools that were not part of the study. The instrument was given to three experts in educational psychology, measurement and evaluation and Biology education, all from the faculty of Education, University of Nigeria, Nsukka. The experts were requested to validate the items in terms of clarity of instructions to the respondents, suitability of items, accuracy of answers and content coverage, clarity of language and expression and appropriateness and adequacy of the items in measuring what they are supposed to measure. Through this procedure the researcher eliminated, modified and selected the set of test items. To determine the reliability of the instrument the data were analyzed using Kuder-Richardson 20 and a reliability coefficient of 0.77 was obtained.

Eysenck General Intelligence Test 4 (EGIT 4)

EGIT-4 (Eysenck, 1981) was used to measure general intelligence. It is a 40-item objective type instrument that assesses components of intelligence like verbal, quantitative and spatial aptitude as well as logical reasoning, making inferences, and problem solving. Using equivalent test, Ihekuna (1991) obtained a test-retest reliability coefficient of .66 for EGIT 4 and correlating EGIT 4 equivalent test with Cattell and Cattell's (1960) Culture Fair Test Scale 2, Ihekuna (1991) obtained a concurrent validity of .46 using Nigerian samples. EGIT-4 was used as a covariate to control for intelligence that may confound results. The essence is to ensure that the students' achievement emanate exclusively from the impact of teachers' self-efficacy factor and not from their general intelligence. Research has shown evidence of strong relationship between general intelligence and academic achievement. This trend has been widely reported for high school students and also among university students (Garcia, Lopez, Jcaran & Burgos, 2014). Correct option in each question is awarded 1 point.

Experimental Procedure

The first stage was to categorize teachers on TSE levels. The SSI Biology teachers were observed for self-efficacy behaviours during their biology classroom teaching in intact classes in each of the selected schools for two periods of 35 minutes each per week, for five weeks. Each item in the self-efficacy Index (TSEI) was presented in a score sheet and the use of each item of the nine components of teacher self-efficacy while teaching was scored 1 mark. The average scores in the TSE for the period of the five weeks were collected using the score sheet. Teachers were categorized on their SE levels according to their scores as follows: 70-100% (High), 55-69% (Moderate) and 40-54% (Low).

Afterward, 90 students (45 males and 45 females) were each assigned to the three levels of TSE and the teachers in the different levels taught their students these selected topics: photosynthesis, mineral requirement of plants, food substances in animals, enzymes, and modes of nutrition in animals and plants at different lesson periods. These are the topics in SS1 syllabus that had not been taught in the selected schools at the time the study was conducted. The essence was to ensure that the students' prior knowledge of the topics in the SS1 biology would not influence their achievement in biology during the study. During the week following the completion of the teaching exercise, BAT was administered to the students in all the conditions (different SE levels of biology teachers). The study adopted a quasi-experimental design because students were assigned to each of the three levels of TSE.

Results

Correlation analysis was conducted to ascertain whether scores on General Intelligence Test (EGIT4) and BAT would positively correlate and it was found that they are both significantly and positively related ($r = 0.57$), $p < 0.1$. This shows that general intelligence may influence performance in Biology. To compare whether students' academic achievement was caused by the teacher self-efficacy or due to the students' general intelligence, Analysis of Covariance

(ANCOVA) was run using general intelligence as a covariate. Chi-square analysis was also used to test the hypothesis relating to differences in the levels of different levels of self-efficacy by biology teachers.

Research Question One: What are the levels of self-efficacy among Biology teachers?

Table 1: Frequency and percentage for teacher self-efficacy (TSE)

TSE Levels	Frequency	Percentage (%)
Above average (High)	4	16
Average (Moderate)	7	28
Below average (Low)	14	56

From Table 1, it is evident that majority of biology teachers 14(56%) scored below average in self-efficacy. They were followed by teachers who had an average score 7(28%). The least number of teachers scored above average 4(16%) in creativity fostering behaviors. Thus, majority of teachers 21(84%) do not adopt self-efficacy when teaching biology.

Research Question two: What are the mean achievement scores of students who are taught by biology teachers of different levels of self-efficacy?

Table 2: Mean achievement and standard deviation scores of Biology students based on different levels of TSE

T Self-efficacy levels	Stud	Mean	Std.dev
High	90	20.12	3.41
Moderate	90	17.26	2.36
Low	90	15.90	2.53

Note: TSelf-efficacy = Teacher self-efficacy

Stud = Students' Number for each level of TSE.

The results as presented in Table 2 indicate that students under high efficacious teachers had a mean BAT score of 20.12 with a standard deviation of 3.41. Those students under moderate and low efficacious teachers had mean BAT scores of 17.26 and 15.90 and standard deviations of 2.36 and 2.53 respectively. From the mean scores, those students under high TSE group performed better than those in other groups. The result suggests that teachers who use high self-efficacy in teaching biology are more effective in enhancing learning achievement than moderate self-efficacious teachers while low self-efficacious teachers came out to be the least effective.

Research Question Three: What are the mean achievement scores of male and female students who are taught by biology teachers of different levels of Teacher self-efficacy?

Table 3: Mean Achievement and Standard Deviation Scores of male and female Biology students based on different TSE levels

T Self-efficacy	Stu Gender	N	Mean	Std. dev
High	Male	62	19.63	15.53
	Female	28	20.61	3.33
Moderate	Male	55	17.49	2.29
	Female	34	17.03	2.47
Low	Male	73	16.26	2.51
	Female	17	15.53	2.58

Note: TSelf-efficacy = Teacher self-efficacy

Table 3 indicates that under high TSE levels, female students had a higher mean achievement score (Mean = 20.61 and Std.dev. = 3.33) than male students (Mean = 19.63 and Std.dev. = 3.44). However, under moderate TSE level male students achieved better than female students (Mean = 17.49 and Std.dev. = 2.29 for males and Mean = 17.03 and Std.dev. = 2.47 for females). Same with those under low TSE (Mean = 16.26 and Std.dev. = 2.51 for males and Mean = 15.53 and Std.dev. = 2.58 for females).

Hypothesis One: There is no significant difference in TSE levels among biology teachers. Table 4 below shows the table of Chi-square analysis.

Table 4: Table of Chi-square analysis

Levels of TSF	Observed N	Expected N	%	χ^2	df	Sig.
				7.0	2	.030*
High	4	8.0	16.67			
Moderate	6	8.0	33.33			
Low	14	8.0	58.33			

TSE = Teacher self-efficacy; * = $p < .05$.

From Table 4, it was discovered that 4(16.67%) of biology teachers had high TSE levels; 6(33.335%) had moderate TSE while 14(58.33%) had low TSE This difference was significant at $\chi^2 = 7.0$, $df = 2$, $P < .05$ with majority of the biology teachers not adopting self-efficacy in teaching their students.

Hypothesis Two: There is no significant difference in the mean achievement scores of students in Biology based on their teachers' levels of self-efficacy.

Table 5: Summary table of Analysis of Covariance (ANCOVA) showing students' overall achievement scores in biology based on different Teacher self-efficacy levels

Source	Sum of Square	Df	Mean square	F	Sig.
Corrected model	790.22	3	263.41	35.11	.000
EGIT 4	106.32	1	106.32	14.17	.000
TSE	562.43	2	281.21	37.48	.000
Error	1988.12	265	7.50		
Total	87930.00	269			
Corrected Total	2778.34	268			

Note: TSE = Teacher self-efficacy

ANCOVA results as shown in Table 5 revealed a significant main effect of Teacher self-efficacy on BAT scores $F(1,265) = 37.48$, $p < .01$. The hypothesis of significant effect was accepted. Table of multiple comparison analysis conducted using Scheffe test is shown below.

Table 6: Post-Hoc test of students' academic achievement in biology based on different levels of Teacher self-efficacy

					95% Confidence Interval for Difference	
TSE(i)	TSE(j)	MD(i-j)	Std. Error	Sig.	Lower Bound	Upper Bound
H	M	2.22	.42	.000	1.20	3.24
	L	3.56	.41	.000	2.57	4.56
M	H	-2.22	.42	.000	-3.24	-1.20
	L	1.35	.41	.004	.35	2.34
L	H	-3.56	.41	.000	-4.56	-2.57
	M	-1.35	.41	.004	-2.34	-3.5

Note: BAT = Biology Achievement Test; H = High TSE; M = moderate TSE; L = low TSE; MD = Mean difference.

The results in Table 6 above shows that students who were thought under high Teacher self-efficacy levels had significantly higher Biology achievement test (BAT) scores, controlling for the effect of their intelligence test scores than students who were under moderate Teacher self-efficacy levels (Mean Difference (MD) = 2.22, $p < .01$) and also students who were under low Teacher self-efficacy (Mean Difference (MD) = 3.56, $p < .01$). Furthermore, students who were under moderate Teacher self-efficacy level had significantly higher Biology achievement test scores, controlling for the effect of their intelligence test scores than students who were under low self-efficacy level (Mean Difference (MD) = 1.35, $p < .01$). Thus, those under low self-efficacy level performed poorly more than other groups. From the mean differences as presented in Table

6, the participants in high and moderate group did significantly better than the low group. However, for low self-efficacy level, the mean difference for high creativity level was far higher than that of moderate self-efficacy level.

Hypothesis Three: There is no significant difference in the mean achievement scores of male and female students in Biology based on their teachers self-efficacy level.

Table 7: Summary table of ANCOVA testing difference in mean Biology Achievement Test (BAT) Scores of male and female students under different TSE levels.

Source	Sum of Square	df	MS	F	Sig.
Corrected Model	235.09	2	117.54	12.29	.000
EGIT 4	231.35	1	231.35	24.20	.000
StuGender	7.30	1	7.30	.763	.383
Error	2543.26	266	9.46		
Total	87930.00	269			
Corrected Total	2778.34	268			

ANCOVA results as shown in Table 7 indicate a no significant effect of teacher self-efficacy on academic achievement of male and female students in Biology $F(1,265) = 37.48$, ns. Thus hypothesis 2 was accepted.

Discussions

The results as found in this study showed that majority of biology teachers do not employ teaching strategies that foster students' academic achievement in biology and teachers who exhibited strong self-efficacy in their teaching turned out students that made substantial achievement gains. Although those who experienced moderate self-efficacy performed better than those in the self-efficacy levels the mean difference in achievement is significantly higher for high self-efficacy teaching. The findings thus suggest that TSE impacts positively on biology students' achievement. This conclusion is in line with extant findings. For example, it has been demonstrated that most teachers do not have self-efficacy skills but practiced traditional teaching which did not promote academic achievement (Al-Najjar, 2012) and increased self-efficacy traits of both male and female teachers subsequently enhanced their academic achievement in Biology (Saudat & Umaru, 2015; Shacter, Thum & Zikfin, 2006). The result of this study could count at least in part, for the findings that self-efficacy teaching could promote greater mastery, retention and students' academic achievement.

Researchers have for long argued that it was crucial for teachers to be efficacious in order to enhance maximum achievement gains in their students (Summak & Aydin, 2011). This is because effective teaching strategies involve student-centered activities, a connection between teaching contents and real-life arrangement of skills in class, open-ended questions, an encouragement of creative thinking and use of technology and multimedia (Hong, 2005). Teachers' self-efficacy as an institutional and purposeful search for innovation in problem solving enable a student to interpret a problem differently and using his or her imaginative thoughts to solve a problem from different perspectives (Okoli & Mbonu, 2014). Thus, when teachers have confidence in their teaching then the students become more engaged and motivated and are more likely to be on than off task (Bowkett, 2006). For example, compared to the control group, teachers who employed self-efficacy in their teaching program had significantly more diverse knowledge, developed a better attitude to teaching and acquired more skills (Hosseinee, 2008).

From the cognitive learning framework teachers' self-efficacy instructions make the learner or problem solver self-sufficient in discovering things for him or herself since the emergence of a solution to problems is illustrative of insight that results from integration with the mental process. Thus, science teachers who adopt self-efficacy in biology classrooms students create opportunities for students to think deeply and develop cognitively. An essential part of enhancing achievement in students therefore is teachers' knowledge of the concept, their attitude and behaviours towards students. The science teacher with an improved knowledge of self-efficacy could generate enabling environment in which individual differences are appreciated. A conducive environment in the science classrooms (teacher – behaviours, attitudes, strategies, and activities) could develop creative thinking in the students that manifest in higher achievement in science.

The result of this study found a no significant gender difference in biology achievement under different TSE levels. Studies that have reported no significant gender difference include Ogundoyin and Olatoye (2007). Others (Okoli and, Mbonu, 2014) reported no difference in achievement of male and female students on general self-efficacy test and on each component of teachers' self-efficacy namely instructional strategies, classroom management, and students' engagement. Also, Duman, Gocen and Yakar (2014) and Naderi, Abdulla, Aizan, Sharir and Kumar (2010) failed to show any meaningful gender difference in achievement with regards to self-efficacy of teachers. Some possible explanations for these findings have been deduced. For example, Akanbi and Kolawole (2014) posit that differences in achievement of male and female students could be taken care of by using good methods, materials and appropriate teaching strategies. Also, in contemporary times, gender discrimination is fast closing up with parents tending to hold similar perception and expectations for their sons and daughters. This parent child relations, family support and encouragement given to both sexes appear to reduce the incidence of gender differences in many accomplishments including biology achievement in the face of different self-efficacy behaviours.

Conclusion

Results of the present study revealed that students who were taught by teachers with high and moderate levels of self-efficacy had better achievement than those taught by teachers with low self-efficacy levels. This is in line with the study of Travis, Brandi & King, (2008). that students in the experimental group who were taught using self-efficacy approach were more interested and appreciated science subjects, had better attendance and increased participation in the laboratory activities than the control group The finding is supportive of the potential benefit of sponsoring pre-service and in-service workshops to enhance teachers' teaching ability and adoption of more effective and engendering strategies in instructional delivery The implication is that schools should provide teachers with encouragement and supportive institutional environment, promote teachers' self-efficacy attitudes, innovative and imaginative behavior through positive reinforcement. This may create the needed support for teachers to cultivate positive work behaviour by actively seeking opportunities for improvement and change. It is therefore, recommended that curriculum planners should include self-efficacy education methods in teacher preparation programs. Further studies should increase sample size and test the findings outside the locale of this study. There is also the need to investigate the impact of TSE on aspects of students' interest in biology.

Acknowledgment

The researchers appreciate all the study participants and **Dr. Christian S. Ugwuanyi** as the corresponding author for this research.

References

- Adu, E. O., Tadu, R. & Eze, I. (2012). Teachers' self-efficacy as correlates of secondary school students' academic achievement in southwestern Nigeria. *Discovery*, 2012,2(4),8-16.
- Akanbi, A.A & Kolawole, C.B (2014). Effect of guided discovery and self-learning strategies on senior secondary school Students' achievement in Biology *Journal of Education and Leadership Development* 5(2), 124-130.
- Al Najjar, J. (2012). The extent of science teachers possessing creative teaching skills in the teachers college in Saudi Arabia. The association of Arab Universities. *Journal of Education Psychology*, 2(10): 149 – 169.
- Aurah, C. & McConnell, T. (2014). Comparative study on pre-service science teachers' self-efficacy beliefs of teaching in Kenya and the United State of America; USA. *American Journal of Educational Research*, 2014, Vol. 2, No. 4. pp. 233-239.
- Babalola, J. B. (2008). Teacher education and the challenges of global economic meltdown. A lead paper delivered in Alayande college of education, Oyo.
- Benson, O.O., Nwagbo, C.R., Ugwuanyi, C.S. & Okeke, C.I.O. (2020). Students' perception of teachers' pedagogical skills and its influence on their attitude towards science: implication for science, technology and engineering careers. *International Journal of Mechanical and*

- Production Engineering Research and Development (IJMPERD), 10(3):14701–14714. <http://dx.doi.org/10.24247/ijmperdjun20201397>
- Bilali, O. (2013). Teaching efficacy to student teachers in the faculty of education, Elbasan, Albania. *Journal of educational and Social Research*, Volume 3(1), pp. 179-185.
- Bowketi, S. (2006). 100t Ideas for teaching creativity, London: Continuum.120-129.
- Bumen NT (2010). The relationship between demographics, self-efficacy, and burnout among teachers. *Eurasian J. Educ. Res.* 40:16-35.
- Burke C (2007). Inspiring spaces: creating creative classrooms. *Curriculum Briefing* 5(2):35-39.
- Cattel, R. B. Cattel, A.K. S. (2000) Test of “g”; Culture fair scale 2 Form A Champaign; I P A T. 23-28
- Dejaeghere, J. G., Williams, R & Kyeyune, R. (2009). Ugandan secondary school headteachers’ efficacy: What kind of training for whom? *International Journal of Educational Development*, 29, pp. 312-320.
- Duman B, Gocen G, Yakar A (2014). The examination of relationships between emotional intelligence levels and creativity levels of preserves teachers in the teaching-learning process and environments. *Pegen J. Educ. Instruction.* 2 : 45 – 74
- Federal Government of Nigeria (FGN) (2004). National Policy on education (2004). Lagos: NERDC Press.
- Garcia, O, Lopez,F,Jacaran, E,& Burgos, S (2014). Reltionship between general intelligence, competences and academic achievement among university students, personality <http://dx.doi.org/10.1016/j.paid.2013.07.296>
- Gorozidis G, Papaioannou A (2011). Teachers’ self-efficacy, achievement goals, attitudes and intentions to implement the new Greek physical education curriculum. *Eur. Physical Educ. Rev.* 17:231-253.DOI:10.1177/1356336X11413654.
- Guvenc H (2011). Autonomy support and self-efficacy perceptions of primary school teachers. *Educational Administration: Theory Practice*, 17(1):99-116.
- Hong J., (2005). Creative teachers and creative teaching strategies *International Journal of Consumer Studies* 29; 352-358
- Hosseini A.(2008). Investigating the impact of the creativity teaching program on teachers’ knowledge, attitude and skills. *The Research and Planning Organization Tehranm Iran.*23-31
- Ikediegwu, N.P. (2005).: Teaching profession who is a real teacher? Gerldrick concept printing and publishing. Enugu
- Jumanne, J. (2012). Teacher self-efficacy in teaching science process skills: An experience of Biology teachers in Morogoro- Tanzania. Retrieved on 25 June 26, 2014 from www.amazon.com/Teacher-eficacy-teaching -science-process/dp/3659262129.
- Kinyua, M. & Oboko, R. (2003). Impact of teacher’s gender in imparting 21st competencies: internal barriers in Kenya secondary schools. Research Project Report. School of computing and informatics, University of Nairobi.

- Klassen, R. M. & Chiu, M. M. (2010). Effects on teachers' self-efficacy and job satisfaction: Teacher gender, years of experience and job stress. *Journal of Educational Psychology*, 2010, Volume 102, Number 3: 741-756.
- Koc, C. (2013). An investigation into elementary school teachers' self-efficacy beliefs and skills for creating constructivist learning environments. Hacettepe University. *Journal of Education*. Special issue 1: 240 – 255.
- Naderi, H: Abdullah, R: Aizan, H.Tj sharer, J: & Kumar (2010). Relationship between creativity and academic achievement; a study of gender differences. *Journal of American Science* 6(I): 181 – 190
- Norom, R.N (2009). Developing entrepreneur skills through science, technology and Mathematics teachers' education: focus on wealth creation, Biology curriculum. 50th Annual Conference Proceeding of Science Teachers Association of Nigeria 134 – 141.
- Nworgu, B. G; Ugwuanyi, C.S & Nworgu, L.N. (2013). School location and gender as factors in senior secondary school students' conceptual understanding of force and motion. *International Journal of Educational Research and Technology*; 4 (4): 71-76.
- Odongo, G. (2011). Teacher perceptions of their readiness to educate children with sensory disabilities in Kisumu local education authority- Kenya: Bringing change that leads to new beginnings. Albuquerque: American Council on Rural Special Education (ACRES) Conference.
- Oginga, E., Muola, J. & Mwanja, J. (2014). The factors influencing the teaching of HIV/IDS education in public primary schools in Kisumu East district, Kenya. *International Journal of Education and Research* Vol. 2, No. 1: 1-14.
- Ogundoyin, J. O. & Olatoye, R. A. (2007). Gender factor, as a correlate of students' performance on creativity and intelligence tests in Oyo state secondary schools. *African Journal for the Psychological Study of Social Issues*. 10(2): 251 – 262
- Ogundoyin, J. O. & Olatoye, R. A. (2007). Gender factor, as a correlate of students' performance on creativity and intelligence tests in Oyo state secondary schools. *African Journal for the Psychological Study of Social Issues*. 10(2): 251 – 262
- Okoli, J.N & Mbonu (2014). Teacher's awareness of strategies for nurturing creativity in secondary school science, technology and mathematics students in Anambra State. *Journal of the Science Teachers Association of Nigeria* 49 (1) 187-205.
- Ozkal, N. (2014). Relationships between teachers' creativity fostering behaviours and their self-efficacy beliefs. *Education Research and Review*, 9 (18) 724 – 733
- Protheroe, N. (2008). Teacher efficacy: What is it and does it matter? *Principal*: 42-45
- Saudat, S. B & Umaru, M (2015). Effect of problem-solving instructional strategy on creativity, and academic achievement in genetics among NCE students *Journal of Science Teachers Association of Nigeria* 56, 173 – 184

- Savran GA, Cakiroglu J (2007). Turkish pre-service science teachers' efficacy beliefs regarding science teaching and their beliefs about classroom management. *Teach. Teacher Educ.* 23:664-675. doi:10.1016/j.tate.2005.09.013.
- Schacter, S., Y. M. Thum & D. Zifkin, (2006). How much does creative teaching enhance elementary school student's achievement? *Journal of Creative Behaviour*, 40: 47 – 72
- Summak, A.E.& Aydin, Z (2011). Researches about creativity and creativity in national Education program. *Journal of New World Sciences Acad. Educ. Sci.* 6(I): 362 -385
- Ugwuanyi, C. S., Okeke C. O., & Ageda T. A., (2020). Psychological predictors of physics learners' achievement: The moderating influence of gender. *Cypriot Journal of Educational Science.* 15(4), 834-842. DOI: 10.18844/cjes.v%vi%i.4635
- Ugwuanyi, C.S., Okeke, C.C., & Okeke, C.I.O. (2022). Influence of preschool librarians' demographic characteristics on their library discipline practices: An Ex-post Facto Research. *Library Philosophy and Practice (e-journal).* 6758. <https://digitalcommons.unl.edu/libphilprac/6758>
- Woolfolk Hoy, Burke Spero R (2005). Changes in teacher efficacy during the early years of teaching: A comparison of four measures. *Teach. Teacher Educ.* 21:343-356. DOI:10.1016/j.tate.2005.01.007.
- Zahrakar, K. A, Rezazade & Q. Ahqar (2010). A study of the effectiveness of problem-solving skills training on female high students' self-efficacy in Rasht. *Innovative Ideas in Educational Science*, 19: 133-150.