

Influence of Qualification of Secondary School Science Teachers on their Perception of Self-Efficacy

Thomas B. Igwebuike¹ Ph.D Martha O. Oghenesuvwe²

1. School of Education, College of Education, P.M.B. 1251, Warri Nigeria

2. School of Sciences, College of Education, P.M.B. 1251, Warri Nigeria

Corresponding Author's e-mail: beluolisa2005@yahoo.com

Abstract

The complexity of science teaching at the secondary school level may have interacted with paucity of instructional materials, equipment and facilities to make science teachers have a poor perception of self-efficacy. This may in part, be implicated in the phenomenon of underachievement in science subjects among secondary school students. This study was designed to investigate the influence of science teachers' qualification on their perception of self-efficacy. An instrument, 'Teachers' Self-Efficacy Scale' was administered on 200 randomly selected secondary school science teachers in Warri Municipality, Nigeria, and its suburbs. Z-test statistic observed at the 0.05 level of significance was used for testing the hypothesis of the study. The results indicated that qualified secondary school teachers had a more positive perception of self-efficacy than their counterparts in all the seven sub-scales of the instrument. Implications of the results were discussed and suggestions were put forward about the direction of further studies.

Keyword: Self-efficacy; underachievement in science; teachers' qualification; perception.

1. Introduction

Teaching science in a way that reflects its fundamental nature is very demanding. The fundamental nature is that which expresses its triadic feature which shows that it is made up of scientific corpus of knowledge, science process skills, and scientific attitudes and values. These three aspects have to be intricately balanced for science to be taught effectively. But science teaching at the primary and secondary school levels is characterized by authoritarian dissemination of corpus of scientific knowledge to students who often listen passively as acolytes to their science teachers. The result of this is that such students do not perform well in terminal and external examinations that often involve use of science process skills in addition to cognitive aspects, as observed by Jegede, Okebukola and Ajewole (1992), West African Examination Council (2010), Igwebuike and Ajuar (2013), and Igwebuike and Ikponmwosa (2013).

It can be conjectured that paucity of science instructional materials, equipment and facilities has conspired with the science teachers' speculated disbelief in their capabilities to make teachers rely solely on transmission of scientific knowledge during science teaching. This disbelief culminates in poor perception of self-efficacy. Bandura (1986) defines self-efficacy as "an individual's judgement of his or her capability to organize and execute the courses of action required to attain designated types of performance". By implication, science teachers with high or positive perceptions of their self-efficacy will accept challenges and redouble their efforts towards attaining maximally the set goals of teaching. This is also incorporated in Gibson and Dembo's (1984) assertion that efficacy expectation is the conviction that a teacher is personally capable of successfully executing actions that will result in the desired and anticipated outcomes. Developing self-efficacy and outcome expectancy in teachers is, according to Khourey-Bowers and Simons (2004), pivotal to achieving scientific literacy for all students. Scientific literacy results when science is effectively taught.

Some strands of research evidence converge to support the claim that teacher self-efficacy positively influences students' learning outcomes. According to Henson (2001) teacher efficacy is found to be one of the important variables consistently relate to positive teaching behaviour and student outcomes. Tschannem-Moran and Hoy (2001) concluded that students taught by teachers that are highly efficacious have high level of academic achievement, autonomy, motivation and a firm belief in their own efficacy. Some positive aspects of teaching profession have been associated with teacher's perception of self efficacy. For instance Caprara, Barbaranelli, Steca and Malone (2006) indicated that one of these aspects is that the teacher is more enthusiastic and satisfied with his job. Another aspect is that the teacher demonstrates, according to Schwarzer and Hallum (2008), lower levels of burnout. By implication, scholars in science education can turn their gaze to nature of perception of self-efficacy by science teachers, among others, in their quest to unravel the phenomenon of students' underachievement in the sciences.

A study was carried out (Soodak & Poodell, 1996) to determine the influence of teaching experience on teachers (not specifically science teachers) perception of self-efficacy. Results of the study, among others, are that teaching experience positively influenced self-efficacy among primary school teachers. In other words, primary school teachers' self-efficacy improved with increase in teaching experience though gradually. For secondary

school teachers, the results indicated that they were more stable in their beliefs about personal efficacy. Teacher education institutions are created to endow prospective and in-service science teachers with knowledge, process skills and scientific attitudes needed for development of self-efficacy. But teaching in those institutions is also characterized by transmission of body of scientific knowledge to the prospective science teachers. A study by Igwebuike, Okandeji and Ekwevugbe (2012) indicated that teacher educators in Colleges of Education in Delta State, Nigeria, had a traditionalist/transmissive conception of teaching and learning, irrespective of their qualification, instead of contemporary/constructivist conceptions. This introduces some penumbra of uncertainty regarding the capacity of the institutions to assist the pre-service teachers develop what it takes to have positive perception of self-efficacy. But there is no empirical evidence to support or not, the ability of such institutions to achieve this because the literature is mute on this.

1.1 Statement of the Problem: The problem investigated in this study, put in a question form is “Is there any statistically significant influence of qualification of secondary school science teachers on their perception of self efficacy?”

1.2 Hypothesis

The hypothesis of this study is: There is no statistically significant difference in the mean perception of self-efficacy between qualified and nonqualified secondary school science teachers. (A qualified secondary school science teacher is the one that has at least a bachelors’ degree in Science and Education, or in Science with at least postgraduate diploma in Education).

2. Methods and Procedures

2.1 Sample

A sample of two hundred science teachers was constituted from a population of science teachers in Warri Township, Nigeria and the suburbs using stratified random sampling. The strata were qualification, gender and experience. Gender and experience were used merely to ensure fair representation of the population in the sample since they were not hypothesized. Of the 200 science teachers, 100 were qualified.

2.2 Instrument

Bandura’s (1994) Teacher Self-efficacy Scale was used for collecting data for testing the hypothesis of this study. This instrument consists of 30 items with responses modeled on a nine point Likert format. It has seven subscales as follows: efficacy to influence decision making; efficacy to influence school resources, instructional self-efficacy; disciplinary self-efficacy; efficacy to enlist parental involvement; efficacy to enlist community involvement; efficacy to create positive school climate. Each of the items is measured on a 9 – point scale with calibration of: Nothing; Very Little; Some Influence; Quite A Bit; and A Great Deal. Adedoyin (2010) did a factor analysis of the instrument using Botswana junior secondary school teachers. He arrived at nine factors (subscales) instead of seven in the Bandura’s (1994) version. He further reduced the 30 items in the original version to 27 because three items had factor loading of less than 0.50. But Bandura’s (1994) version was used in this study because Adedoyin (2010) did his factor analysis with a Botswanan sample which is different from the sample of the present study. Secondly, the present study did not contemplate determination of the factorial purity of the subscales. This somehow precipitates a limitation of study.

However, part of psychometric integrity of the instrument was determined using test-retest method and a different sample of science teachers (n=48) in Warri- Nigeria. The exercise yielded a reliability coefficient of 0.764 which is well above the threshold value of 0.60 recommended by Nunnally (1981). In addition to that, and since analysis of the data was based on the individual sub-scale, the reliability coefficient for each of the sub-scales was determined. The results are shown in Table 1.

Table 1: Sample Items of the Sub-scales and their Reliability Coefficient

S/N.	Sub-Scale	Sample Item	Reliability Coefficient
1.	Efficacy to Influence Decision	How much can you influence the decisions that are made in the school?	0.79
2.	Efficacy to Influence School Resources	How much can you do to get the instructional materials and equipment you need?	0.87
3.	Instructional Self-Efficacy	How much can you do to increase students' memory of what they have been taught in previous lesson?	0.72
4.	Disciplinary Self-Efficacy	How much can you do to control disruptive behaviour in the classroom?	0.77
5.	Efficacy to Enlist Parental Involvement	How much can you assist parents in helping their children to do well in school?	0.69
6.	Efficacy to Enlist Community Involvement	How much can you do to get community groups involved in working with the school?	0.75
7.	Efficacy to Create a Positive School Climate	How much can you do to get students to believe they can do well in school work?	0.71

2.3 Procedure for Data Collection

The instrument was administered to the subjects (members of the sample) personally by one of the researchers. She clarified the demands from the instrument and ensured 100% per cent retrieval rate by substitution of a few non-usable questionnaires.

2.4 Procedure for Data Analysis

Analysis of data was carried out using Z-test statistic observed at the 0.05 level of significance.

3. Results and Discussion

3.1 Results

The hypothesis of this study is, 'There is no significant difference in the mean perception of self-efficacy between qualified and non-qualified secondary school science teachers'. The hypothesis was tested from the mean score perception on each of the seven sub-scales. The results are presented below.

3.1.1 Sub-Scale 1: Efficacy to Influence Decision-Making Process

Table 2: Z-test of Group Mean Perceptions

Group	N	\bar{x}	SD	Std-Error	Z_{cal}	Z_{tabled}
Qualified	100	12.93	3.26	0.45	5.59*	1.96
Non-Qualified	100	10.47	2.99			

* Significant at the 0.05 level of significance

From Table 2, the group mean obtained for qualified teachers is 12.93 with a standard deviation (SD) of 3.26 while that for non-qualified teachers is 10.47 with a standard deviation of 2.99. The difference between these two group means is significant because the Z-value calculated (observed) is greater than the tabled value. Qualified secondary school science teachers therefore have a better perception of self-efficacy in influencing decision-making process.

3.1.2 Sub-scale 2: Efficacy to Influence School Resources

Table 3: Z-test of Group Mean Perceptions

Group	N	\bar{x}	SD	Std-Error	Z_{cal}	Z_{tabled}
Qualified	100	6.36	1.91	0.15	6.93*	1.96
Non-Qualified	100	5.36	0.84			

* Significant at the 0.05 level of significance

Table 3 shows that qualified teachers had a group mean perception of 6.36 and an SD measure of 1.91 while non-qualified teachers had a mean of 5.36 with an SD measure 0.84. The calculated Z value of 6.93 is greater than the tabled value of 1.96 by implication the difference between the two group means is statistically significant in favour of qualified teachers. The conclusion therefore is that qualified secondary school science teachers have a superior perception of their self-efficacy with respect to influencing school resources.

3.1.3 Sub-scale 3 Instructional Self-Efficacy
Table 4: Z-test of Group Mean Perceptions

Group	N	\bar{x}	SD	Std-Error	Z _{cal}	Z _{tabled}
Qualified	100	58.00	13.45	1.87	5.46*	1.96
Non-Qualified	100	47.79	12.95			

* Significant at the 0.05 level of significance

Table 4 indicates that the mean perception of instructional self-efficacy by qualified teachers is 58.00 with an SD value of 13.45 while non-qualified teachers had a mean of 47.79 with an SD measure of 12.95. The calculated Z value is 5.46 while the tabled value is 1.96. By implication there is statistically significant difference in mean perception of instructional self-efficacy between qualified and non-qualified secondary school science teachers.

3.1.4 Sub-scale 3 Instructional Self-Efficacy
Table 5: Z-test of Group Mean Perceptions

Group	N	\bar{x}	SD	Std-Error	Z _{cal}	Z _{tabled}
Qualified	100	21.31	4.83	0.51	16.39*	1.96
Non-Qualified	100	12.13	2.79			

* Significant at the 0.05 level of significance

From Table 5, the group mean perception by qualified science teachers is 21.31 with an SD measure of 4.83 while their non-qualified counterparts had a group mean of 12.13 and with an SD value of 2.79. The calculated Z value is higher than the tabled value of Z. By implication qualified science teachers with higher group mean had a more positive perception of disciplinary self-efficacy.

3.1.5 Sub-scale 5: Efficacy to Enlist Parental Involvement
Table 6: Z-test of Group Mean Perceptions

Group	N	\bar{x}	SD	Std-Error	Z _{cal}	Z _{tabled}
Qualified	100	46.49	6.74	0.94	38.20*	1.96
Non-Qualified	100	10.58	6.58			

* Significant at the 0.05 level of significance

Table 6 shows that the group mean for qualified science teachers on perception of self-efficacy to enlist parental involvement is 46.49 with an SD measure of 6.74. The group mean for their non-qualified counterparts is 10.58 with an SD measure of 6.58. The difference in the group means was found to be statistically significant in favour of qualified science teachers. This means that qualified secondary school science teachers have a more positive perception of self-efficacy to enlist parental involvement.

3.1.6 Sub-scale 6: Efficacy to Enlist Community Involvement
Table 7: Z-test of Group Mean Perceptions

Group	N	\bar{x}	SD	Std-Error	Z _{cal}	Z _{tabled}
Qualified	100	36.68	8.29	1.12	11.63*	1.96
Non-Qualified	100	23.66	7.52			

* Significant at the 0.05 level of significance

From table 7, qualified secondary school science teachers had a group mean perception of 36.68 with an SD value of 8.29 while their non-qualified counterparts had a mean of 23.66 with an SD value of 7.52. The Z calculated value is 11.63 while the tabled value is 1.96. These values imply that there is statistically significant difference in perception of self-efficacy to enlist community involvement between qualified secondary school science teachers and their counterparts who were not qualified in favour of the qualified teachers.

3.1.7 Sub-scale 7: Efficacy to Create Positive Social Climate
Table 8: Z-test of Group Mean Perceptions

Group	N	\bar{x}	SD	Std-Error	Z _{cal}	Z _{tabled}
Qualified	100	62.77	8.57			
Non-Qualified	100	44.79	3.63	0.93	19.33*	1.96

* Significant at the 0.05 level of significance

From table 8, the group mean perception of self efficacy to create positive social climate by qualified secondary school science teachers is 62.77 with an SD measure of 8.57. The group mean for their non-qualified counterparts is 44.79 with an SD measure of 3.63. Since the Z-calculated value is higher than the tabled value, there is statistically significant difference between the two groups. The qualified secondary school science teachers had a more positive perception of their self-efficacy for creating positive social climate.

It is also noteworthy that despite the fact that qualified secondary science teachers had superior perception of their self-efficacy for all the seven sub-scales, their standard deviation measures were higher than those of their counterparts. This means that homogeneity or intra group agreement among qualified secondary school teachers, with respect to each of the sub-scales, is lower than that for their non-qualified counterparts.

3.2 Discussion

The major problem addressed in this study was investigation to reveal if there would be any difference in the perception of self-efficacy in each of the seven sub-scales of Teacher Self-Efficacy Scale developed by Bandura (1997). Evidence provided by the analysis carried out shows support for the potency of teacher education programmes in making secondary school science teachers to develop positive perception of self-efficacy. According Bandura (1986), and as mentioned earlier, self-efficacy “is an individual’s judgement of his or her capability to organize and execute the courses of action required to attain designated type of performance.” It was conjectured that because of the difficulties that might be encountered in trying to teach science meaningfully to secondary school students, science teachers may have poor perceptions of their self-efficacy. The difficulties stem, among others, from the conspiracy between the complex nature of science and paucity of provision of instructional materials, equipment and facilities. It was expected by the researcher that science teacher education programmes would boost the science teachers perception of self-efficacy. But some penumbra of uncertainty was cast on the expectation by the observation that teacher educators in Colleges of Education in Delta State, Nigeria, had a traditionalist/transmissive conception of teaching and learning (Igwebuike, Okandeji & Ekwevugbe, 2012) which negate meaningful teaching of science by the recipients. This, it was speculated, could make the recipients to have poor perception of self-efficacy for teaching science.

It is therefore gratifying, as well as heart-warming, to observe that evidence provided by this study provide support for the potency of science teacher education programmes in making science teachers to have positive perception of self-efficacy. Gorrell and Capron (1990) suggest that it is important to instill a sense of efficacy in people being prepared to teach to ensure that they have the confidence to attempt to apply their knowledge when the appropriate time comes. They are supported by Dembo and Gibson (1985). The results obtained from this study are supported rather tangentially by the findings of studies by Asikhia (2010), Dahar, Dahar and Dahar (2011) and Unanma, Abugu, Dike and Umeobika (2013). For instance, Unanma, et al, (2013) in particular found that qualification of chemistry teachers at the senior secondary school level influenced positively the academic achievement of the students in chemistry. The support is referred to as tangential because self-efficacy is perceived competence (Anderson, Walker & Ralph, 2009) which, by implication, resulted in improved academic achievement established by the findings of studies by Unanma, et al (2013) among others. Improved academic achievement is the ultimate. McLaughlin and Marsh (1978) long ago, found that teacher efficacy had positive impact on: achievement of a project goal, the level of adjustment made by the teacher, students’ achievement, among others.

The results of the present study and the literature in this study converge to support the positive influence of teacher-perceived self-efficacy on students’ achievement in school work. A cursory view of the items in some of the sub-scales of Teacher Self-Efficacy Scale used in this study offers some explanation to the results of this study. For instance, one of the sub-scales “Disciplinary self-efficacy has an item which states, ‘How much can you do to control disruptive behaviour in the classroom?’ shows that self-efficacy is patently, a precursor of enhanced academic achievement. In the sub-scale, - Instructional Self-efficacy, an item states, ‘How much can you do to motivate students who show low interest in school work?’ Another one states ‘How much can you do to increase students’ memory of what they have been taught in previous lessons?’. All things being equal, a teacher who has positive perception of his competence to do these and others specified in the various sub-scales, would achieve his instructional goals.

4. Conclusions and Implications

4.1 Conclusions

Evidence provided by the analysis of data from this study support the conclusion that secondary school chemistry teachers' qualifications influence positively their perceptions of self-efficacy as teachers.

4.2 Implications

Since self-efficacy has been shown in the literature as something that engenders academic achievement by students science teacher educators, education policy makers and other stakeholders should be made to be aware of this. Science teachers in secondary schools that are not qualified should be assisted to develop themselves professionally through in-service education programmes. This is largely because of the observation earlier in this study, that secondary schools students perform poorly in the sciences. It is justifiable to implicate lack of qualification for science teaching in this poor achievement continuing saga of underachievement in science. Another implication of the findings of this study, though tangential, is that self-efficacy building should be specifically included in the programme for internship/teaching practice for pre-service science teachers perhaps by way of practicum. The ultimate goal of this, according to Anderson, Walker and Ralph (2009) is to assist practicum pre-service teachers to "become more self-efficacious practitioners who will continue to engage in professional development throughout their careers in the school setting" (p. 168).

How to achieve this can indicate direction for further studies. In addition, further studies can increase the sample size, and widen the scope, and incorporate more variables, like teaching experience and gender to improve our knowledge on interaction of factors that can influence perception of self-efficacy among science teachers.

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