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ORIGINAL ARTICLE

EXAMINING THE EFFECT OF TEACHING PRACTICE ON PRESERVICE BASIC SCIENCE TEACHERS' SCIENCE TEACHING EFFICACY BELIEFS

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Abstract:

This study investigated the effect of the teaching practice on science teaching efficacy beliefs among 340 Nigerian preservice basic science teachers from three different universities within the blueprint of one-group pre-treatment, post-treatment quasi-experimental research design. In this study, Science Teaching Efficacy Beliefs Instrument (STEBI-B) was used to collect data. Results of the study indicated that the preservice basic science teachers had high self-efficacy beliefs regarding science teaching. More so, teaching practice did have significant effect on preservice basic science teachers' science teaching efficacy beliefs although gender had no significant effect on preservice basic science teachers' science teaching efficacy beliefs.

KEYWORDS:

Teaching practice, Preservice basic science teachers, Science Teaching Efficacy Beliefs

INTRODUCTION:

There is no doubt that most basic education teachers have some challenges in teaching some subjects in the school curriculum. In particular, basic science is one subject perceived difficult by both preservice and inservice teachers as they feel inadequately prepared to teach it in primary and junior secondary schools. Basic science was introduced into the Nigerian primary and junior secondary school curriculum in September 2008 (Awofala & Sopekan, 2013) following the full implementation of the new nine-year basic education curriculum as a replacement for integrated science. This change in curriculum was partly necessitated by some gaps noticed in the old curriculum and the need to make the curriculum more responsive to the needs and aspirations of the Nigerian people and be in tandem with the home-grown curriculum reform agenda (Awofala, Olaoluwa & Fatade, 2013; Awofala, 2012; Awofala, Ola-Oluwa, & Fatade, 2012; Awofala & Awolola, 2011a; Awofala & Awolola, 2011b).

Evidence suggests that both preservice and inservice teachers lack the confidence to teach (basic) science and their self-efficacy regarding (basic) science teaching at the primary and junior secondary school level is very low (Schoeneberger & Russell, 1986; Enochs & Riggs, 1990, Riggs, 1991, Mulholland & Wallace, 2000, Appleton, 2003; Mulholland, Dorman, & Odgers, 2004). Preservice teachers are found to display low level of understanding of basic science concepts and hold misconceptions of fundamental science concepts (Tekkaya, Çakıroğlu & Özkan, 2002). Self-efficacy belief is one of the factors that influence elementary science instruction (Aydin & Boz, 2010) including mathematics (Akinsola & Awofala, 2009) and Koballa and Crawley (1985) offered the scenario whereby elementary school teachers judged their ability to teach science to be low (belief), resulting in a dislike for science teaching (attitude) that ultimately translated into teachers who avoided teaching science (behaviour).

Teachers' self efficacy belief is an indicator of teachers' instructional behaviour in the classroom (Plourde, 2002; Tobin, Tippins, & Gallard, 1994) and is derived from the social learning theory and the construct of self-efficacy of Bandura (Bandura, 1977). Perceived self-efficacy is beliefs in one's

capabilities to organize and execute the courses of action required to manage prospective situations (Bandura, 1986) and provides the foundation for human motivation, well-being and personal accomplishment (Aydin & Boz, 2010). In Bandura's theory, self-efficacy expectation is one source of behaviour, the other being outcome expectation. Outcome expectancy is a given behaviour that will lead to certain outcomes (Bandura, 1997) while self-efficacy expectation is defined as one's beliefs about personal capabilities for successfully executing the behaviour needed to produce outcomes (Akinsola & Awofala, 2009; Savran & Çakıroğlu, 2003). In relation to teaching, Rotter (1966) identified two dimensions of efficacy namely general teaching efficacy (GTE) and personal teaching efficacy (PTE). While the former focuses on teachers' beliefs about the power of external factors compared to the influence of teachers and schools and corresponds to Bandura's outcome expectancy the latter is more specific and individual than a belief about what teachers in general could accomplish and it corresponds to Bandura's self-efficacy expectation (Tschannen Moran, Hoy & Hoy, 1998).

Pintrich (1990) suggested that teachers' beliefs would ultimately prove to be the most valuable psychological construct to teacher education and according to Sarikaya (2004) the responsibilities for teaching all subjects in an elementary instruction necessitates that a specific measure of science teaching efficacy belief should more accurately predict science teaching behaviour. Besides that students of teachers with a stronger sense of personal efficacy give more positive evaluations of the teacher (Woolfolk, Rosoff, & Hoy, 1990) teachers who do not believe in their ability to teach science (low self-efficacy) are more likely to avoid science instruction whenever possible than teachers with higher self-efficacy (Enochs, Scharmann & Riggs, 1995). Teacher efficacy is related to student achievement (Tschannen Moran, Hoy & Hoy, 1998; Hoy, 2000; Bıkmaz, 2004), student motivation (Midgley, Feldlaufer & Eccles, 1989), teachers' adoption of innovation (Berman, Mc Laughlin, Bass, Pauly & Zellman, 1977; Guskey, 1988; Smylie, 1988), student control ideology (Woolfolk & Hoy, 1990) and teachers' classroom management strategies (Aydin & Boz, 2010; Bezzina & Butcher, 1990; Ross, 1994; Soodak & Podell, 1994; Ashton & Webb, 1986). Teachers with high teaching efficacy beliefs have the tendency to implement diverse methods of instruction and are more confident in teaching (Allinder, 1994) and show more humanistic orientation in controlling students whereas teachers with low teaching efficacy beliefs have a rigid control over students (Woolfolk & Hoy, 1990).

Teacher efficacy influences students' attitudes toward school, the subject matter being taught, and even the teacher (Aydin & Boz, 2010) and teaching practice affects preservice teachers' efficacy beliefs (Plourde, 2002). Teaching practice, notwithstanding the length or duration, is an excellent opportunity for preservice teachers to experiment and test their knowledge and skills in an authentic teaching and learning environment in tandem with own understanding of their personal educational philosophies and theories (Kabilan & Izzaham, 2008). It also provides an opportunity to gather information about preservice teachers' personal capabilities for teaching and to be tested their beliefs (Katrina, 2004). Although preservice teachers are taught theories underlining teaching and learning and made to engage in microteaching, many preservice teachers may be flecked when made to practicalise the microteaching experience in a real classroom setting.

Yılmaz and Çavaş (2007) investigated the effect of the teaching practice on 185 preservice elementary teachers' science teaching efficacy beliefs from two different universities in Izmir, Turkey using the Science Teaching Efficacy Belief Instrument (STEBI-B) and found that in spite of almost all preservice elementary teachers had high self-efficacy beliefs regarding science teaching, the teaching practice experience did not affect preservice elementary teachers' science teaching efficacy beliefs. In support of this finding, Romi and Daniel as cited in Woolfolk Hoy and Burke-Spero (2005) and Lin & Gorrell (2001) showed a decline or no change in the preservice teachers' self-efficacy beliefs (Romi & Daniel, as cited in Woolfolk Hoy & Burke-Spero, 2005; Lin & Gorrell, 2001) during the teacher education programmes and they attributed the decrease to realization of the difficulties in teaching. However, some studies in the literature indicated that preservice teachers' teaching efficacy beliefs increased during the teacher education programmes (Hoy & Woolfolk, 1990; Gorrell & Hwang, 1995; Mulholland, Dorman & Odgers, 2004) and attributed this to the difference with mastery experience in teaching practices of preservice teachers as well as other courses such as method courses, observing successful models and learning environments encouraging pre-service teachers (Ramey-Gassert & Shroyer, 1992; Scharmann & Hampton, 1995; Huinker & Madison, 1997).

Based on this background therefore, there is no consensus on the effect of teacher education programmes on preservice teachers' self-efficacy beliefs and the mixed findings regarding the effect of teaching practice on the efficacy beliefs of preservice science teachers (Yılmaz & Çavaş, 2007; Plourde, 2002) provided the motivation for the present study. The present study aimed to investigate the effect of the teaching practice on preservice basic science teachers' science teaching self-efficacy beliefs.

THE PROBLEM

The lack of consensus regarding the effect of teaching practice on the efficacy beliefs of preservice science teachers provided the needed impetus for the present study. Thus, the present study investigated the effect of the teaching practice on preservice basic science teachers' science teaching self-efficacy beliefs. The following research questions guided the study:

Research Question One: Is there any significant difference between the self-efficacy beliefs of preservice basic science teachers before and after the teaching practicum?

Research Question Two: Is there any significant difference between the male and female preservice basic science teachers with regard to their teaching self-efficacy beliefs before and after the teaching practicum?

SCOPE AND LIMITATION OF THE STUDY

1. The study is limited to 340 preservice basic science teachers in three universities in South West Nigeria.
2. Topical Scope: The topical scope is limited to the study of the effect of teaching practice on preservice basic science teachers' science teaching efficacy beliefs.
3. Analytical scope: The analytical scope is limited to answering of the two research questions for the study.
4. The results are dependent upon data collected with the study instruments and analysed by inferential statistic of both the independent and paired samples t-test.

METHODOLOGY

RESEARCH DESIGN

This study employed a one- group pre-treatment, post-treatment research design.

SUBJECTS

The participants for this study were 340 preservice basic science teachers (142 males and 198 females) who were enrolled in three different public universities in South West Nigeria and the whole were seniors being ready to be teachers in junior secondary schools. Altogether their ages ranged between 19 and 31 years (M=23.3, SD = 2.5).

INSTRUMENTATION

The present study used one instrument: Science Teaching Efficacy Belief Instrument (STEBI-B). The Science Teaching Efficacy Belief Instrument (STEBI-B) was developed by Enochs and Riggs in 1990 to measure preservice elementary teacher's self-efficacy beliefs toward science teaching. The STEBI-B consists of 23 items in a five- point Likert type scale ranging from strongly agree to strongly disagree and has two subscales; Personal Science Teaching Efficacy (PSTE) including 13 items and Science Teaching Outcome Expectancy (STOE) including 10 items. The instrument has been used widely in different settings and found reliable and valid (Aydin & Boz, 2010; Wingfiled, Freeman & Ramsey, 2000; Bleicher, 2001, 2002; Bleicher & Lindgren, 2002). In the present study the STEBI-B has a reliability coefficient of 0.90 and its two dimensions PSTE and STOE were found to have reliability coefficients of 0.82 and 0.79 respectively. The STEBI-B was amended to reflect a four-point scale in the present study.

PROCEDURE

The STEBI-B was administered to the preservice teachers before and after their teaching practice. The researcher in company of two trained research assistants visited the classrooms to apply the instrument to the students in the three universities.

RESULTS

Descriptive statistics were conducted to analyse the preservice basic science teachers' STEBI-B scores. As shown in Table 1 below, the means of pre and post-PSTE scores on STEBI-B for the preservice basic science teachers were 40.27 and 45.30 respectively. These mean that the preservice basic science

teachers have high personal science teaching efficacy that they have necessary skills to teach science effectively. The preservice basic science teachers' mean scores for pre-STOE and post-STOE were 29.38 and 34.35 respectively. These mean that the preservice basic science teachers have high level of science teaching outcome expectancy which student learning can be influenced by given effective instruction.

Table 1:

Descriptive statistics of STEBI-B scores

Variable	N	Maximum	Minimum	Mean	SD
Pre-PSTE	340	47	23	40.2735	5.01548
Post-PSTE	340	52	28	45.2971	5.02296
Pre-STOE	340	35	18	29.3824	4.15422
Post-STOE	340	40	21	34.3529	4.16746

An independent samples t-test was used to determine if there was any significant difference between the male and female preservice basic science teachers with regard to their self-efficacy beliefs before and after the teaching practice. As shown in Table 2 below, there was no significant difference between the mean scores of males and females' science teaching efficacy beliefs before ($p>.05$) and after ($p>.05$) the teaching practice.

Table 2:

Independent samplest-Test comparison of Male and Female regarding STEBI-B

Subscale	Gender	N	Mean	SD	df	t	p
Pre-PSTE	Male	142	40.5303	4.96143	338	-1.115	.266
	Female	198	39.9155	5.08578			
Post-PSTE	Male	142	45.5253	4.96146	338	-.989	.323
	Female	198	44.9789	5.10801			
Pre-STOE	Male	142	29.6616	4.11406	338	-1.466	.144
	Female	198	28.9930	4.19303			
Post-STOE	Male	142	34.6616	4.12023	338	-1.617	.107
	Female	198	33.9225	4.20920			

A paired-samples t-test was conducted to evaluate the impact of the teaching practice on science teaching efficacy beliefs of preservice basic science teachers. As shown in Table 3 below, mean scores on STEBI-B for PSTE subscale changed from 40.27 to 45.30, indicating an increase of 5.03. There was a statistically significant difference between the pre-treatment (before teaching practice) and post-treatment (after teaching practice) means on the PSTE sub-scale ($t339=169.02$, $p<.001$). Mean scores on the STEBI-B for STOE changed from 29.38 to 34.35, indicating an increase of 4.97. There was a statistically significant difference between the pre-treatment and post-treatment means of the STOE ($t339=139.80$, $p<.001$).

Table3:

Paired Sample t-Test (Two-Tailed) Results for STEBI-B

Variable	Tests	N	Mean	SD	df	t	p
PSTE	Pre-test	340	40.2735	5.01548	339	169.024	.000
	Post-test	340	45.2971	5.02296			
STOE	Pre-test	340	29.3824	4.15422	339	139.800	.000
	Post-test	340	34.3529	4.16746			

DISCUSSION

Teaching self-efficacy beliefs have be shown to influence preservice teachers' perceived success before entering the teaching profession (Aydin & Boz, 2010; Yılmaz & Çavaş, 2007) and are a common concern of preservice teachers educational studies (Weinstein & Mignano, 1993; Weinstein, 1996). The most important factor, which affects or change preservice teachers' believes is the teaching practice experience (Yılmaz & Çavaş, 2007) and has been seen as the event in a preservice teacher's educational career that warrants the application of that theoretical knowledge and transforms the "pre-service teacher" to "real teachers" (Katrina, 2004). According to Plourde (2002), this experience gives the preservice teachers the opportunity to apply their content and pedagogical knowledge with children and to further develop personal teaching philosophies. The present study replicated the study by Yılmaz and Çavaş (2007) by investigating the effect of the teaching practice on preservice basic science teachers' science teaching efficacy beliefs.

The results from the analyses showed that there were significant differences between the PSTE and STOE mean scores of preservice basic science teachers both before and after the teaching practice. This is an indication that the teaching practice experience did have influence on the preservice basic science teachers' science teaching efficacy beliefs. This finding contradicts the findings of some studies (Yılmaz & Çavaş, 2007; Gencer & Çakıroğlu, 2007; Ginns & Watters, 1999) that found that completing teaching practice course and additional educational courses were not a significant factor in preservice teachers' self-efficacy beliefs. However, the present study finding agrees with the findings of Wingfield et al. (2000) who found significant changes in both self-efficacy and outcome expectancy of preservice teachers after the teaching practice experience. This is in support of some studies in the literature that indicated that preservice teachers' teaching efficacy beliefs increased during the teacher education programmes (Hoy & Woolfolk, 1990; Gorrell & Hwang, 1995; Mulholland, Dorman & Odgers, 2004) and this significant effect has been attributed to the difference with mastery experience in teaching practices of pre-service teachers as well as other courses such as method courses, observing successful models and learning environments encouraging pre-service teachers (Ramey-Gassert & Shroyer, 1992; Scharmann & Hampton, 1995; Huinker & Madison, 1997). While studies conducted in this field to date indicate that the teaching practice experiences influence preservice teachers' efficacy beliefs either positively or negatively, studies related to STEBIB reported mixed results in terms of significant changes in the two subscales, self-efficacy (PSTE) and outcome expectancy (STOE) (Ginns, Tulip, Watters & Lucas, 1995; Plourde, 2002; Bleicher & Lindgren, 2005). Some studies (Cantrell, Young, & Moore, 2003; Schoon & Boone, 1998; Tosun, 2000) found significant changes in self-efficacy, but not in outcome expectancy whereas others (Ginns, Tulip, Watters & Lucas, 1995; Plourde, 2002) found significant changes only in outcome expectancy. However, the discrepancies in these findings could be related to the way efficacy was measured (Tschannen-Moran, Woolfolk, & Hoy, 2001), the significant phase of socialisation effect (Hoy & Woolfolk, 1990) and the fluctuating experiences in teacher education programme (Ginns et al., 1995; Ashton & Webb, 1986).

In addition to the effect of teaching practice investigated on preservice teachers' science teaching efficacy beliefs, the present study also examined the gender differences if any on preservice basic science teachers' science teaching efficacy beliefs. Results revealed no significant differences in self-efficacy beliefs scores between males and females preservice basic science teachers. These findings are consistent with the other studies conducted in more developed society (Yılmaz & Çavaş, 2007; Gencer & Çakıroğlu, 2007; Celep, 2000; Savran, 2002). However, there is inconsistency among the results of other studies in this area. In terms of science teaching efficacy beliefs, some researchers found that males demonstrated significantly higher science teaching self-efficacy beliefs than did their females (Bleicher, 2004; Enochs & Riggs, 1990) before teaching practice. However, after teaching practice, there was no statistically significant difference in preservice male and female teachers' self efficacy beliefs (Yılmaz & Çavaş, 2007). These researchers maintained that methods courses in teacher education programmes focus on preservice teachers' own experiences with science and past education inequities and female teachers need support to change their beliefs about self-efficacy regarding teaching science (Riggs, 1991; Brandon, 2000; Howes, 2002; Kiviet & Mji, 2003; Mulholland et al., 2004). However, conflicting findings regarding gender differences in learning outcomes including science teaching efficacy beliefs should be expected since studies differ in learning contexts such as methodology, samples, areas of study, research tasks, and classroom settings (Fatade, Nneji, Awofala, & Awofala, 2012).

CONCLUSION

This study though a replica of Yılmaz and Çavaş (2007) study arrived at different results. The present study revealed that there were statistically significant differences between the PSTE and STOE

mean scores of preservice basic science teachers both before and after the professional teaching practice exercise. This difference could be attributed to differences in culture, context, sample and orientation of preservice teachers. However, a longitudinal study may be conducted to better understand the modification in preservice teacher's beliefs. Qualitative methods may also be applied in future studies to enhance our understanding of pre-service teachers' potential differences in students' interpretation of experiences relating to self-efficacy beliefs. In agreement with other researchers (Yılmaz & Çavaş, 2007), the findings of this study can help to develop and improve teacher education programmes and preservice teachers' teaching practices by bridging the gap between theory and practice. Preservice science teachers should be involved in constructivist teaching in order to enhance their science teaching efficacy beliefs and they should be encouraged to adopt minds-on and hands-on instructional strategies (Awofala, 2011) and be observant during their field experiences. Preservice teachers need out-door experiences for efficiency in lesson planning and teaching skills for their overall professional development.

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