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ARTICLE

Science Teaching Efficacy Beliefs of Palestinian Elementary Education Students

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Abstract: To assess elementary education students' self-efficacy beliefs in science teaching, the Science Teaching Efficacy Belief Instrument developed by Enochs and Riggs was used. The instrument consisted of two scales, Personal Science Teaching Efficacy Belief Scale and the Outcome Expectancy Scale. It was administered to 90 undergraduate university students majoring in elementary education at a large public Palestinian university. Results indicated that students' self-efficacy beliefs in science teaching were comparable to those reported in the original study by Enochs and Riggs. Overall, the participants presented moderate to high self-efficacy in science teaching.

Keywords: Self-efficacy; Elementary education; Science teaching; Palestinian

1. Introduction

Besides research on teachers' knowledge and development, researchers acknowledge the importance and influence that beliefs have on teaching and learning, specifically in developing accurate descriptions of the teaching process. According to Kagan [1], teachers' belief is a personal knowledge that lies at the very heart of teaching. Teachers' self-efficacy beliefs, which indicate the way teachers evaluate their abilities to facilitate positive change in students [2], are identified as critical in teachers' effectiveness [3]. Bandura [4] stated that self-efficacy refers to "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments." In this context, Bandura [5] indicated

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that self-efficacy is how one perceives what they can do. Naidoo and Naidoo [6] indicated that teachers' self-efficacy beliefs relate to teacher effectiveness, student learning, and predict future teaching practices. Researchers (e.g., [7]) identified personal teacher efficacy beliefs and general teacher efficacy beliefs as two teaching effectiveness beliefs. Personal teacher efficacy beliefs are a teacher's belief in their teaching abilities. General teacher efficacy beliefs are general beliefs about teaching. Tella [8] found teachers with high self-efficacy persist in circumstances of failure, take more curriculum risks, incorporate innovative teaching approaches toward students' achievement, and have more motivated students.

Further, researchers (e.g., [9]) found a positive relationship between teacher productivity and high self-efficacy ratings. Practices indicated growing persistence with students in circumstances of failure, less didactic teaching, higher professional commitment, and commitment to identifying more effective instructional strategies. Also, Haatainen, Turkka and Aksela [10] reported that teachers' experiences with integrated activities and classroom practices correlated with self-efficacy. Boz and Cetin-Dindar [11] investigated the relationship among teaching concerns, efficacy, and classroom preference for pre-service science teachers. Their sense of self-efficacy was negatively correlated with teaching concerns. However, their sense of efficacy was positively correlated with the constructivist learning environment. In their research [12] on self-efficacy and support strategies for teachers, experienced teachers reported higher self-efficacy in the areas of instructional strategies and classroom management and lower for student engagement. In the same perspective, Yesilyurt, Deniz and Kaya [13] studied the instructional strategies and learning experiences that worked to improve pre-service elementary teachers' use of engineering education intervention. Their study indicated that incorporating engineering design activities with explicit-reflective instruction for engineering concepts has the potential to improve pre-service teachers' personal engineering teaching efficacy beliefs.

Caprara et al. [14] assessed the relationship between teacher efficacy beliefs and student academic achievement and found positive correlations between teacher efficacy beliefs and student achievement. Although Klassen et al. [15] found there to be only "modest" support that teacher efficacy beliefs and student achievement are positively related. According to Austin [16], it is premature to assert that positive relations found between teacher efficacy beliefs and desirable teaching practices or outcomes support the claim that stronger teacher efficacy beliefs result in improved teaching, pointing to further study. Nevertheless, self-efficacy is considered a key component of motivation [17] and predicts academic achievement and contributes to students' performance [8,18-21]. Moreover, it is also revealed that teachers with a high sense of self-efficacy beliefs will introduce teaching innovations in educational reform enactment [22,23].

Elementary science teaching is neglected as more time is spent on other subjects, although teaching elementary science is very important, especially in a technologically cultured era. Over the past three decades or so, there has been research in self-efficacy beliefs but very few studies have studied this area with respect to science teaching. The concept of self-efficacy is minimally investigated in the Middle East region. Among Palestinian students, little or no research has been done, to date, on science teaching self-efficacy. Research on teacher's self-efficacy is needed because it is one of the determinants of teacher's quality in the classroom. The purpose of this study was to assess self-efficacy beliefs in science teaching of Palestinian university students majoring in elementary education who were enrolled in a science methods course for elementary school teachers. To achieve the purpose of this study, the following research question was answered: what were the self-efficacy beliefs in science teaching of Palestinian university students majoring in elementary education?

2. Materials and Methods

Participants were 90 Palestinian students in a public Palestinian university monitored by the Palestinian Authority. This university was selected for this study because of its convenient location to the researcher and its recognition as a deeply rooted and esteemed university. They were students majoring in elementary education and were admitted into the teacher education program. They were enrolled in education courses, some of which included a field component. For the purpose of this study, participants were recruited from the methods of teaching science course for elementary school teachers, a course focusing mainly on science methods for teaching elementary science. Participants completed a core science content course in the first year of the program. The participants consisted of 35 men (38.9%) and 55 women (61.1%), all of whom volunteered their participation, remained anonymous, and were not offered any incentives for participating. Their ages ranged from 20 to 25 years (mean = 21.3 years, SD = 1.09). Of the participants, 48.9% of them were in their third year and 51.1% of them were fourth year students in a four-year undergraduate teacher education program. Students in these two years are usually few, which explains the relatively small sample size. Students were Palestinians. All were Arabic speaking

and Arabic was the language of instruction.

To measure the elementary education students' self-efficacy beliefs in science teaching, the Science Teaching Efficacy Belief Instrument developed specifically for elementary science by Enochs and Riggs [24] was used. The Science Teaching Efficacy Belief Instrument is considered a useful tool for observing teachers' science teaching self-efficacy beliefs at different points in their career. It is a valid and reliable instrument designed for use by preservice teachers of elementary science. It has 23 items, 13 positive statements about science (e.g., I know the steps necessary to teach science concepts effectively) and 10 negative statements (e.g., I will not be very effective in monitoring science experiments). It consists of two scales, the Personal Science Teaching Efficacy Belief Scale composed of 13 items designed to address preservice teachers' level of belief in their ability to teach science, and the Outcome Expectancy Scale composed of 10 items to assess participants' belief that their teaching will positively impact their students. Elementary education students in this study were surveyed to determine their self-efficacy beliefs according to the Teaching Efficacy Belief Instrument. Responses were recorded on a 5-point rating scale anchored by 1: Strongly Disagree and 5: Strongly Agree. Negatively worded statements were scored in reverse with "strongly agree" receiving a score of one. High scores on the Personal Science Teaching Efficacy Belief show a strong belief in teaching science. Scores can range from 13 to 65. High scores on the Outcome Expectancy show high expectations regarding the outcomes of science teaching. Scores on the scale can range from 10 to 50. Results of Enochs and Riggs [24] provided support for the construct validity of the instrument. The validity of the instrument was also investigated [25] and results supported the two-factor structure presented by the original authors. On this basis, construct validity of the instrument was accepted as a priority in the present study. The instrument was translated from English to Arabic. A formal back translation was not done; however, three education professors who are native Arabic speakers attested to the translation's adequacy. A demographic information sheet was used to gather information of participant characteristics including gender, year in the university, and age. Quantitative methods were used for data analysis in this study. The researcher entered the collected data into SPSS. Descriptive statistics provided answers to the research question.

3. Results

Enochs and Riggs [24] indicated that the Science Teaching Efficacy Belief Instrument is a valid and reliable instrument; and reported an internal consistency reliability of 0.90 for the Personal Science Teaching Efficacy Belief Scale and 0.76 for the Outcome Expectancy Scale. In the current study, Cronbach alpha [26] values of 0.78 and 0.65 were obtained for the two scales, respectively. The lower reliability of the Science Teaching Efficacy Belief Instrument scales is relatively consistent with previous research findings [3]. The widely recognized threshold for Cronbach alpha is 0.7 [27], nonetheless additional research is needed in this area. Moss et al. [28] considered a value of 0.6 as acceptable and DeVellis [29] considered it as undesirable. The low alpha of the Outcome Expectancy Scale can also be interpreted by the relatively small number of items (10) that constitute this scale.

The means and standard deviations for the measure items are in Table 1. Scores for the science teaching efficacy belief instrument ranged between 2.19 to 4.28. The negatively stated items were not reversed in the item mean calculations below. Thus, items in this table are presented as they appeared in the instrument. The overall mean and standard deviation for the 13 items of the Personal Science Teaching Efficacy Belief Scale scores were 3.34 and 0.57. The overall mean and standard deviation of the 10 items of the Outcome Expectancy Scale scores were 3.40 and 0.57. The medians for both scales were 3.4 for the Personal Science Teaching Efficacy Belief Scale and 3.53 for the Outcome Expectancy Scale. It is noted that the negatively stated items were reverse scored in the overall mean and median calculations. Overall, the elementary education students presented moderate to high self-efficacy in science teaching. Similar results were found in Riggs and Enochs [3] study, who developed the Science Teaching Efficacy Belief Instrument. There was not a statistically significant difference between the mean scores of female students and the mean scores of male students in elementary science teaching efficacy beliefs. Therefore, gender may not have meaningful influence on participants' science teaching efficacy beliefs.

Table 1. Item Means and Standard Deviations

Item	Measure	*Mean*	*Std Dev*
	Personal Science Teaching Efficacy Belief Scale		
2	I will continually find better ways to teach science	4.24	0.71
3	Even if I try very hard, I will not teach science as well as I will most subjects	2.93	0.95
5	I know how the steps necessary to teach science concepts effectively	3.52	0.92
6	I will not be very effective in monitoring science experiments	2.94	1.02
8	I will generally teach science ineffectively	2.19	1.21

Table 1 continued

Item	Measure	*Mean*	*Std Dev*
12	I understand science concepts well enough to be effective in teaching elementary science	3.53	1.12
17	I will find it difficult to explain to students why science experiments work	3.07	1.07
18	I will typically be able to answer students' science questions	3.53	0.80
19	I wonder if I will have the necessary skills to teach science	3.10	1.02
20	Given a choice, I will not invite the principal to evaluate my science teaching	3.09	1.24
21	When a student has difficulty understanding a science concept, I will usually be at a loss as to how to help the student understand it better	3.74	1.09
22	When teaching science, I will usually welcome student questions	4.28	0.84
23	I do not know what to do to turn students on to science	2.60	1.20
	Outcome Expectancy Scale		
1	When a student does better than usual in science, it is often because the teacher exerted a little extra effort	3.60	1.01
4	When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach	3.91	0.87
7	If students are underachieving in science, it is most likely due to ineffective science teaching	3.42	1.02
9	The inadequacy of a student's science background can be overcome by good teaching	4.03	0.76
10	The low science achievement of some students cannot generally be blamed on their teachers	3.48	1.00
11	When a low-achieving child progresses in science, it is usually due to extra attention given by the teacher	3.46	0.96
13	Increased effort in science teaching produces little change in some students' science achievement	3.66	0.84
14	The teacher is generally responsible for the achievement of students in science	3.16	1.13
15	Students' achievement in science is directly related to their teacher's effectiveness in science teaching	3.68	0.96
16	If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher	3.82	1.01

Negatively stated items (3, 6, 8, 10, 13, 17, 19, 20, 21, 23) were not reverse scored in this table.

4. Discussion

The present study assessed the self-efficacy beliefs in science of elementary students majoring in education. Overall, participants presented moderate to high self-efficacy beliefs. It is worth noting that educational experiences contribute to the reported results in this study. Research supports beliefs that science teaching self-efficacy increase when teachers have more education on a content area [30,31]. Morrell and Carroll [32] found that the methods course used in their study positively impacted the elementary preservice teachers' self-efficacy beliefs. They also found that the science teaching self-efficacy beliefs of preservice elementary teachers, specifically those whose efficacy is low, can possibly be improved through an increase in science content or knowledge as it may positively affect how they regard their abilities to teach science. To understand how efficacy beliefs vary in differing content areas, a more closely crafted analysis of the effects of teacher efficacy beliefs are needed [16]. In mathematics, teachers with higher levels of mathematical teaching knowledge exhibited a strong conceptualization of teacher efficacy beliefs. Teachers with additional mathematical knowledge may indicate feelings of being better prepared to teach [33]. Moreover, the assessment of science teaching efficacy beliefs can contribute to the training of preservice elementary education students. If found early on, low self-efficacy in science teaching can be used to provide activities to preservice elementary education students [24]. They added that field experience, peer teaching, and microteaching self-evaluations may improve science teaching self-efficacy beliefs. Studying additional contextual factors that can potentially affect teacher efficacy beliefs are needed for understanding them. Stipek [34] research on administrative support showed teachers to have a stronger sense of teacher efficacy when they feel supported by administration. Knoblauch and Hoy [35] noted that school setting (rural, urban, or suburban) can affect teacher efficacy beliefs. Raudenbush et al. [36] found that teacher efficacy beliefs differ based on student populations. Content area high school teachers feel most effective when teaching honors courses and least effective in general student population courses.

In terms of limitations, participants were from one Palestinian university. The study's scope and generalizability include only the elementary education program's students for this university when the data were gathered. In addition, the measurement of self-efficacy beliefs was limited to the instruments' validity and reliability. To complete the instrument included in the study, participants were asked to choose provided responses. Responses were restricted by the structure of the instrument. Further and more systematic research is needed to better understand self-efficacy beliefs in elementary education students. Since self-efficacy beliefs are likely to relate to the ef-

fectiveness of elementary education students, thorough study of self-efficacy beliefs has a potential benefit for effectiveness of education students' training and quality of elementary education. Especially for Palestinians, little research has been conducted on elementary education students and teachers and a need exists for studies in every subject that deal concerning elementary education. Interest from society in elementary education is moving towards the improvement of elementary education in general. In further study, interviews where elementary education students explain their self-efficacy beliefs and their learning experiences in elementary science teaching may provide a better perspective on the results reported here.

Conflict of Interest

The authors declare to have no conflict of interest.

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