ELEMENTARY TEACHERS' SCIENCE SELF EFFICACY BELIEFS IN THE EAST AZERBAIJAN PROVINCE OF IRAN

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This study measures the self-efficacy of elementary teachers in science classrooms. The information is obtained from the administration of an adapted self-efficacy test developed by Riggs and Enochs in 1990 to 215 elementary teachers of the East Azerbaijan Province of Iran. The major findings were (1) the STEBI instrument is a reliable and valid tool for studying elementary teachers' beliefs toward science teaching and learning, (2) the teachers try to teach science in better ways; however, they need to have in-service education on more understanding science contents, and necessary skills to conduct science experiment, (3) they have a negative belief toward helping low achieving pupils, and (4) finally a significant difference on the Science Teaching Outcome Expectancy Scale was found between the female and male teachers. The females performed better than the males in that scale (t=2.51 at the .05 level).

Investigations into teachers' self-efficacy indicate that elementary teachers' self-efficacy beliefs are the most important variables in predicting the teachers performance in science classrooms (e.g. Schunk & Hanson, 1985). The conceptual model of these studies grew out of Bandura's social cognitive theory (Bandura, 1977, 1982, 1986). As Bandura pointed out "a person self-efficacy expectation concerning the ability to successfully perform a given task is a reliable prediction of whether the person will attempt the task, how much the person will persevere in pursuing the task in the face of unforeseen difficulties" quoted in Randhawa, Beamer and Landberg (1993). It is also believed that self-efficacy will rise if one acquires skills in a given tasks (Schunk, 1984).

It has been argued that a belief can shape an attitude and both cause a behaviour. Attitude is positive or negative feelings about phenomena, while belief is "information that a person accepts to be true" and both shape behaviour (Koballa & Crawley, 1985). Riggs and Enochs (1990) based on

Koballa and Crawley's description give the following examples to show the relation between attitudes, beliefs, and behaviours:

"An elementary teacher judges his/her ability to be lacking in science teaching (belief) and consequently develops a dislike for science teaching (attitude). The result is a teacher who avoid teaching science if at all possible (behaviour)." This relationships gears researchers to study elementary teachers' beliefs about science teaching to predict their teaching qualities in science classrooms.

The basic theory elaborated by Bandura (1977) considers that a person's behaviour or behaviour change directed by the person's belief about his/her ability to perform a given task. These are known as self-efficacy beliefs. Two components of self-efficacy theory are referred to as self-efficacy expectations and self-efficacy outcomes (Riggs & Enochs, 1990). In this manner Bandura (1986), indicated that self-efficacy expectations, which are concerned with the perception of performance capability, play a more fundamental role in determining behaviour than outcome expectations. This theory has provided a useful framework to understand the performance of teachers in their classrooms.

Researchers thus far demonstrated that self-efficacy (1) is positively correlated with internal locus of control (Anderson & Schneir, 1978, & Gist, 1987), (2) is useful for investigation of behaviour and behaviour change in teacher education (Guskey, 1988, Woolfolk, Rosoff, & Hoy, 1990), and (3) significantly influences teachers' activities in mathematics (Schunk, 1987), and in science education domains (e.g. Czerniak & Waldon, 1991). It is also shown that science self-efficacy is predictive of academic persistence (Lent, Brown, & Larkin, 1984, 1986) and that student achievement is related to teacher self-efficacy belief (Ashton & Webb, 1982). Furthermore, teacher self-efficacy may account for individual differences in teacher effectiveness (e.g. Brophy & Everston, 1981).

Despite these findings little research exists on the self -efficacy of teachers, especially on elementary teachers who are intended to teach science. Now the importance of elementary school science is widely accepted (NSBCPEMST, 1983). It is regarded as a fundamental transition to later scientific concept development. However, as Schoeneberger and Russell (1986) pointed out "elementary teachers do not feel science curriculum has

a high priority." These belief systems influence their teaching methods and the effort they make in science classes. Thus, a study of elementary teachers' self-efficacy in science area could provide information about teachers with respect to instructional process, activities, effort and task accomplishment.

PURPOSE

The purpose of this study was to measure the elementary teachers' self-efficacy in science teaching. More specifically, the research sought data to answer the following questions:

1. What is the status of the elementary teachers' self-efficacy in science teaching?
2. Is there a difference between the subjects in regard to each demographic variable, such as experience, education, and gender difference, with their self-efficacy scores?
3. What is the relation between self-efficacy outcomes and self-efficacy expectations among the subjects?

METHOD

Subjects

The subjects were 215 in-service elementary teachers from the East Azerbaijan Province of Iran who were randomly chosen from rural and urban areas. Of the subjects there were 117 female and 98 males. The mean ages of the subjects were 36.11 (women), and 34.55 (men) years.

Procedure

Each subject completed part of a questionnaire to gather data on gender, age, years of experience, years of education after high school, and the grade level which he/she teaches.

The science teaching efficacy belief instrument (STEBI) was used. The science self-efficacy scale developed by Riggs and Enochs (1990), was translated into Persian and after a pilot study small changes were done on some of the items of the test without changing the main constructs. Thus, the adapted STEBI was administered requiring 20-25 minutes to complete.

The STEBI instrument consisted of 25 items using a Likert-type scale (Riggs & Enochs, 1990). The response categories were "strongly agree," "agree," "uncertain," "disagree," and "strongly disagree." Positively-worded items received 5 for "strongly agree" down to 1 for "strongly disagree." Negatively worded items received 5 for "strongly disagree" down to 1 for "strongly agree." The STEBI is composed of two subscales: Personal Science Teaching Efficacy Belief Scale (self-efficacy dimension) and Science Teaching Outcome Expectancy Scale (outcome expectancy dimension).

The content validity of the STEBI was established by a panel of science educators (Riggs & Enochs, 1990). Once again, the content validity of the instrument, in this study, was established by a panel of five well-known elementary teachers, one science educator, and two secondary science teachers. They generally agreed with constructs measured by the test.

The reliability of the STEBI was assessed with samples of 24 teachers who responded to the test items. The coefficient alpha was 0.72.

RESULTS

The means and standard deviations of items and total scale are given in Table 1. The demographic characteristics and breakdowns of scale are shown in Table 2.

Table 1
Item Means and Standard Deviations (N=215)

	Measure	Pos-Neg	Mean	Std Dev
Science Teaching Efficacy Belief Scale	Item 2	P	4.47	.73
	Item 3	N	3.75	1.14
	Item 5	P	3.84	.95
	Item 6	N	3.64	1.11
	Item 8	N	4.03	1.03
	Item 12	P	3.47	1.20
	Item 17	N	3.81	1.01
	Item 18	P	3.90	1.11
	Item 19	N	3.84	1.20
	Item 21	N	3.76	1.23
	Item 22	N	3.89	1.06
	Item 23	P	4.57	.80
	Item 24	N	3.95	1.05
	Total Scale		50.57	7.19
Science Teaching Outcome Expectancy Scale	Item 1	P	4.38	.57
	Item 4	P	4.39	.82
	Item 7	P	3.16	1.30
	Item 9	P	4.01	1.00
	Item 10	N	2.82	1.29
	Item 11	P	3.80	1.17
	Item 13	N	3.73	1.19
	Item 14	P	3.86	1.12
	Item 15	P	4.29	.78
	Item 16	P	4.25	.79
	Item 20	N	3.71	1.19
	Item 25	N	3.16	1.27
	Total Scale		45.50	4.92

For the Science Teaching Outcome expectancy scale (Oescale), women scored significantly greater than men for outcome expectancy dimension (t=2.51, p>.05). However, there was no significant difference on the Personal Science Teaching Efficacy Belief scale (Sescale) between the two groups (t=0.4, p>.05).

Table 2
Demographic Characteristics and Breakdowns of Scale Scores

Variables	N	%	Mean Sescale	Mean Oescale
Gender:				
Female	117	54.4%	50.57	46.27*
Male	98	45.6%	50.36	44.59
Grades Taught:				
First	41	19.4%	50.58	44.58
Second	32	14.9%	49.31	46.16
Third	41	19.4%	50.88	45.05
Fourth	41	19.4%	50.29	44.98
Fifth	58	27.0%	51.24	46.21
Combination	2		Sample Inadequate	
Teachers Experience:				
1 - 5	27	12.6%	49.96	44.00
6 - 10	59	27.4%	51.12	45.15
11 - 15	49	22.8%	52.02	45.05
16 - 20	30	14.0%	49.93	44.88
21 - 25	37	17.2%	50.03	46.07
26 - 30	11	5.1%	46.27	46.67
Area:				
Rural	92	43.3%	51.09	45.10
Urban	123	57.2%	50.19	45.80

* Significantly different at the .05 level (Oescale only).

Additional t-tests were undertaken for both scales with the demographic characteristics such as years of education after high school (t=1.73), and urban and rural teachers (t=.15). There was no significant difference between the two demographic characteristics and the total self-efficacy scores.

One way analysis of variance ANOVA was conducted on the other demographic variables, namely number of years the subjects have taught [F(4,207)=.49] and the grade level the subjects are teaching [F(29, 179)=.66] with the total scores on the scales. Once again, there was no significant differences between the two sets of variables.

Item analysis was conducted on the both scales and shown in Table 3. The highest correlation was 0.62 for item 24 related to a belief on what to do to turn student on to science. The lowest correlation was related to item 1 (.21) concerning a belief that student doing better in science is related to the teacher effort. Item analyses based on subscales of the Sescale and Oescale revealed that the items from each scale correlated highly among themselves. However, the correlation between the Oescale and the Sescale was low (r=.24). According to Ghisell, Campbell and Zedeck (1981) this pattern shows homogeneity within and distinctiveness between the scale and enhances construct validity.

Reliability analysis of the Personal Science Teaching Efficacy scale produced an alpha of .91 with 13 items and for the Science Teaching Outcome scale an alpha of 0.71 with all 12 items.

Table 3
Item-Total Correlations (N=213)

	Measure	Pos-Neg	I-T Cor	I-Sescale Cor
Personal Science Teaching Efficacy Belief Scale	Item 2	P	.41	.43
	Item 3	N	.45	.51
	Item 5	P	.33	.40
	Item 6	N	.49	.57
	Item 8	N	.53	.62
	Item 12	P	.31	.42
	Item 17	N	.59	.66
	Item 18	P	.56	.68
	Item 19	N	.50	.52
	Item 21	N	.40	.48
	Item 22	N	.58	.70
	Item 23	P	.32	.41
	Item 24	N	.62	.68
Total Scale Alpha = .91				
				I-Oescale
Science Teaching Outcome Expectancy Scale	Item 1	P	.21	.41
	Item 4	P	.37	.47
	Item 7	P	.28	.39
	Item 9	P	.30	.43
	Item 10	N	.25	.44
	Item 11	P	.27	.43
	Item 13	N	.39	.40
	Item 14	P	.35	.51
	Item 15	P	.33	.49
	Item 16	P	.23	.42
	Item 20	N	.40	.38
	Item 25	N	.41	.41
Total Scale Alpha = .71				

DISCUSSION AND IMPLICATION

The results of this study support those of previous research. The reliability of the Sescale and the Oescale, using Cronbach's alpha coefficient, gave values of .91 and .71 respectively (see Table 3). Similar results were found by Riggs and Enochs (1990) of .92 for the Sescale and .77 for the Oescale. The content validity of the STEBI was confirmed in both the previous research and in this study. The homogeneity of within each scale and distinctiveness between the scales were shown in this study. This indicates that each scale measures a distinctive characteristic. Thus, the results of this study indicate that the STEBI instrument is a valid and reliable tool for studying elementary teachers' beliefs toward science teaching and learning.

Regarding the notion that self-efficacy belief is a reliable prediction of current and future performance (e.g. Bandura, 1977, Bandura, Adams, Hardy, & Howells, 1980), the results of this study reveal that elementary teachers have efficient skills in the following science activities (a mean above 4 from 5 as shown in Table 1):

1. The teachers try to find better ways to teach science (item 1).
2. The teachers welcome student questions (item 23).
3. The teachers make extra effort with the purpose that their students do better than usual in science (item 1).
4. The teachers found more effective teaching approaches to improve the science grades of students (4).
5. The teachers overcome the inadequacy of students' background by good teaching (item 9).
6. The teachers believe that student achievement in science is directly related to the teachers' effectiveness in science teaching (item 15).
7. The teachers acknowledged that the performance of the teacher is related to increasing students interest in science at school (item 16).

Contrary to the above results, the teachers do not confirm that if some students are underachieving in science it is related to ineffective science teaching, and teaching abilities (Responses to items 7, 10, and 25 with means of less than 3.25).

An interesting finding is that the teachers have a little difficulty in understanding science concepts to be effective in teaching elementary science (item 12). Thus, it can be concluded that they will limit the topic of classroom conversation to concepts where their expectations is high.

Of particular importance for science teaching is the fact that the teachers also have problems in conducting and doing experiment in science (item 6).

Based on this study, it appears that the teachers need to have in-service education on more understanding of science concepts and the necessary skills to conduct science experiments.

It is also found that the teachers score lower on items of the Oescale than the Sescale (Table 1). Once again, based on the Oescale, one can conclude that the teachers have negative beliefs toward helping low achiever pupils, thus, a special training is required to overcome these negative beliefs (Table 1, item 10).

There was a significant difference between the scores on Oescale, related to outcome expectancy on science teaching, of the female and male teachers (Table 2). The female teachers performed slightly higher than the male ones in relation to outcome expectancy. Thus, female teachers expect certain behaviours such as effective teaching can influence student learning. The responsibility of teacher for achievement in science, and teachers with good science teaching abilities can help low achiever kids, more than of the male teachers.

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