

# Pre-Service Teacher Self-Efficacy Beliefs Regarding Science Teaching: A Comparison of Pre-Service Teachers in Turkey and the USA

Results from a study to compare preservice elementary teachers' efficacy beliefs at a large Turkish university and at a large American Mid-Western university indicate that the preservice elementary teachers in these two countries may have different science teaching efficacy beliefs.

The issue of teachers' efficacy is of importance as teacher preparation programs throughout the world attempt to address shortages of qualified, competent teachers. In the field of science education, monitoring and reacting to the issue of efficacy seems to be one way in which teacher preparation programs are evaluating the structure of programs. In developing countries there is an immediate need for qualified and innovative science instruction as governments attempt to insure that a pool of scientists, engineers and computer specialists are trained for business and academic research and citizens are provided with (and retain) some understanding of science. This study provides a comparison of the self-efficacy of future science teachers in two countries (one developed and one rapidly developing). Analysis suggests what might be learned to aid teacher preparation programs in many settings.

Teachers' sense of efficacy is a construct derived from Bandura's

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(1977) theory of self-efficacy in which the generalized behavior of an individual is based upon two factors, (a) a belief about action and outcome; and (b) a personal belief about one's

ability to cope with a task. Tschannen-Moran and Woolfolk Hoy (2001) defined teacher efficacy as a teacher's "judgment of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated." (p.783)

Teacher efficacy has been found to be one of the important variables consistently related to positive teaching behavior and student outcomes (Gibson & Dembo, 1984; Ashton & Webb, 1986; Enochs et al., 1995; Woolfolk & Hoy, 1990; Henson, 2001). Research on the efficacy of teachers suggests that behaviors such as persistence at a task, risk taking, and the use of innovations are related to degrees of efficacy (Ashton & Webb, 1986). For example, highly efficacious teachers are more likely to use open-ended, inquiry, student-directed teaching strategies, while teachers with a low sense of efficacy were more likely to use teacher-directed teaching strategies such as lecture or reading from the textbook. Research indicates

that students generally learn more from teachers with high self-efficacy than those same students would learn from those teachers whose self-efficacy is low (Ashton & Webb). Woolfolk and Hoy argue that teacher efficacy is one of the few constructs about teachers that is related to “the behavior of learning of students.”

The construct of teacher efficacy has been explored by a number of researchers in recent years. For example, Tschannen-Moran et al. (1998) proposed a model of efficacy that integrates several important components of social cognitive (Bandura, 1997) and locus of control theories (Rotter, 1966). Within this model, teacher’s efficacy judgments are the result of the interaction between a personal judgment of the relative importance of factors that make teaching difficult and a personal assessment of his or her personal teaching competence or skill.

Bandura (1986) argues that teacher efficacy is a situation-specific and even subject-specific construct. For example, a teacher’s self-efficacy may be low while teaching science, but high while teaching language arts. For this fictitious teacher they may devote more time to language arts instruction in comparison to science. Furthermore this teacher might have more personal interest in participating in professional development activities related to language arts as opposed to science.

Enochs and Riggs (1990) claimed that a teacher’s belief system is important in elementary science teaching. They suggest that two types of beliefs seemed relevant, belief that student learning can be influenced by effective teaching (outcome expectancy beliefs) and confidence or belief in one’s own teaching ability

(self-efficacy belief; Gibson & Dembo, 1984). Having one belief being high, for instance outcome expectancy, does not mean a strong belief with respect to the other measure. Riggs (1991) reported that elementary school teachers with low science teaching efficacy beliefs avoided science teaching even though their outcome expectancy beliefs regarding teaching generally were high.

Studies evaluating cross-cultural comparisons of teacher efficacy

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suggest that preservice teachers in different cultures vary in the degree to which they believe themselves to be efficacious in their teaching (Campbell, 1996; Gorrell & Hwang, 1995; Lin & Gorrell 2001; Rich, Lev & Fischer, 1996; Yeung & Watkins, 2000). These studies suggested that the concept of teacher efficacy may be influenced by the unique features of cultures (Gorrell, Hazareesingh, Carlson, & Stenmalm-Sjoblom, 1993; Gorrell & Hwang; Lin & Gorrell; Lin, Gorrell and Taylor, 2002). For example, using a modified version of a teacher efficacy scale developed by Gibson and Dembo (1984), Lin and Gorrell suggested the existence of a different factor structure compared with the

original scale developed with a sample of Taiwanese preservice teachers. They concluded that the concept of teacher efficacy may be culturally oriented and needs to be carefully examined when applied to teachers in different countries. Similarly, Lin et al. examined the influence of culture and education on U.S. and Taiwan preservice teachers’ efficacy beliefs, they found that preservice teachers in these two countries may have conceptually different expectations of teaching (e.g. parental support, social awareness, individual efforts). They suggested that in both countries, preservice teachers’ efficacy beliefs may be influenced by the context of their academic programs, by their increasing competence and experience as teachers, and by cultural perspectives. In another study, Rich et al. (1996) conducted a study to examine the validity of the Gibson and Dembo teacher efficacy scale. When translated to Hebrew and administered to Israeli teachers, results indicated a factorial structure of this particular teacher efficacy scale similar to that observed with an American sample of students. Gorrell et al. (1993) compared American, Swedish, and Sri Lankan preservice teachers and found that American preservice teachers had more positive general efficacy of teaching beliefs compared to Swedish and Sri Lankan teachers. However, Sri Lankan teachers’ personal efficacy beliefs were found to be higher than that of American preservice teachers. In another study, Campbell (1996) compared teacher efficacy beliefs of preservice and inservice teachers in Scotland and America and found no significant difference between the two countries with regard to teacher efficacy.

Gorrell & Hwang (1995, p. 101) have argued that there is a research trend towards “understanding teaching and teacher education in terms of development of teaching and personal efficacy beliefs.” They suggested that teacher efficacy is an important topic for comparative studies between the United States and other nations. “Studies with preservice and inservice teachers both in the United States of America and in other countries would profit from examining closely the growth of teaching and personal efficacy as teachers expand their teaching orientations and their experiences” (Gorrell & Hwang, p. 104).

### A Brief Comparison of Two Teacher Education Institutions-One Turkish, One American

The American and Turkish systems of teacher education have many similarities and differences. The Turkish system of teacher preparation, for example, is currently very centralized when compared with

the American system. In Turkey, elementary school teachers are educated through undergraduate programs of four years in duration. All of the teacher education programs throughout Turkey are required to offer core coursework for preservice elementary teachers that is suggested by the Higher Education Council (YÖK, 1998). All of the teacher education programs in Turkey are intended to educate prospective teachers for the schools of the Ministry of National Education, which has centralized the curricula throughout the country (Çakiroglu & Çakiroglu, 2003). The students attending teacher education programs in Turkey are selected through a nation-wide university entrance examination that is used to identify students for all university programs. Elementary education programs in Turkey presently use a curriculum which has resulted from teacher education reform efforts which have been taking place in the country since 1998. As a result of these reforms, more emphasis has been placed upon improved field experiences, fostering technology literacy, and providing

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teaching methods for subject matter courses (Simsek & Yildirim, 2001).

During the 4 year preservice elementary teacher education program in Turkey, students are required to complete coursework that concerns both general education and subject matter areas. Students must also satisfy a practice teaching requirement. The four years of coursework is a total of 152 credits hours (YÖK, 1998). The list of science related courses required of Turkish students is provided in Table 1, for the authors believe the number of science courses preservice teachers complete is relevant information with regard to science teaching efficacy.

Quite contrary to the Turkish system, teacher certification requirements in the USA are determined by each state and as a result, colleges and universities must develop curricula and related experiences to comply with these varied, state by state, regulations. In the United States there are no national requirements for teacher preparation, quite contrary to that observed in Turkey.

During the 4 year American program evaluated in this study, preservice elementary teachers complete a total of 128 credits

Table 1  
*Science related courses the sample of preservice teachers were required to complete in Turkey and USA*

Courses	Turkey Credit Hours	USA Credit Hours
Scientific Inquiry .....	–	3
Biology.....	3	3
Earth Science .....	6	3
Chemistry .....	3	–
Physics .....	3	3
Ecology.....	3	3
Science Teaching Methods.....	6	5 <sup>a</sup>

<sup>a</sup> Includes a 2 credit hour field experience. In the methods courses of the Turkish students, there is no accompanying field experience.

## **In general, USA preservice teachers have stronger personal science teaching efficacy beliefs than Turkish preservice elementary teachers.**

from four different areas—general education, an area of concentration (e.g. science, math, social studies), electives and professional education. The general education component includes courses in numerous subject areas such as language arts, fine arts, mathematics, science, and social studies. The area of concentration enables students to gain an in-depth knowledge in a subject of their choice. The professional component includes a series of subject-specific methods courses (work within the field of psychology/learning, applying technology in education settings, multicultural courses, the history of American education, an examination of the purpose of schooling in America) field experiences, seminars, and a final semester-long student teaching experience.

### **Purpose**

The purpose of this study is to compare preservice elementary teachers' efficacy in a Turkish university, and in at a major American university located in the Midwest. While researchers have examined preservice teachers' efficacy extensively in United States, there is little work which has been carried out concerning preservice teachers' efficacy beliefs regarding science teaching in Turkey, and perhaps not

surprisingly no research has been done comparing how Turkish students' self-efficacy in science teaching might compare to their peers at an American institution. The information provided by this study may not only help one to better understand Turkish preservice elementary teachers' efficacy beliefs regarding science teaching, but also reveal possible differences and similarities between students of these two different countries with respect to teacher efficacy beliefs. Knowledge of preservice teachers' efficacy beliefs is an important step if positive educational experiences are to be designed for preservice teachers in teacher education programs in Turkey. Knowledge of how students of these two countries compare will help one see how students might be similar and dissimilar. This might help one revisit assumptions one might have about a particular program of study for preservice science teachers.

### **Instrument and Data Collection**

The data for this study were collected by utilizing Enochs and Riggs' (1990) Science Teaching Efficacy Belief Instrument (STEBI-B). The STEBI-B is comprised of two subscales; personal science teaching efficacy beliefs (PSTE, 13 items) and science teaching outcome expectancy (STOE, 10 items). High scores on the first scale, relative to other respondents, indicate a strong personal belief in one's own efficacy as a science teacher, and high scores on the second scale indicate high expectations of the outcomes of science teaching—for instance confidence in how students will do in science.

In order to develop a Turkish language version of the STEBI-B the original instrument was translated into

Turkish by the researchers. The next step involved an independent back translation of the Turkish version into English by two qualified, bilingual Turkish graduate students who were not involved in the original translation. Then the Turkish researchers checked the back translations and, for some items, necessary modifications in the Turkish translation were carried out. Turkish pilot test results produced alpha coefficient of 0.86 for PSTE subscale and 0.79 for STOE subscale. A factor analysis suggests the factorial structure of the STEBI-B developed by Enochs and Riggs (1990) with their American sample of students was the same structure as that observed for this sample of Turkish students.

All of the Turkish participants were enrolled in a four year teacher education program. In the Turkish sample there were 100 preservice elementary teachers (48 female and 52 male) and in the American sample there were 79 preservice elementary teachers (65 female and 14 male). The data were collected by convenient sampling and all preservice teachers from both countries participated voluntarily in the answering of questionnaires.

### **Data Analysis**

The stochastic Rasch model was used to evaluate the survey data. One important benefit of the model is that it can provide estimates of item difficulty and person ability and/or attitude that are relatively invariant over different samples (Green, 1996). The Rasch model converts non-linear raw scores of person and items to measures on a linear logit scale. It is critical to point out that parametric tests assume the use of a linear scale. Thus, the utilization of raw scores from survey instruments potentially

Table 2  
Descriptive statistics based upon raw scores

	Turkish Students		USA Students	
	PSTE	STOE	PSTE	STOE
N.....	100	100	79	79
Minimum.....	3.0	3.30	3.38	2.70
Maximum.....	5.54	5.85	5.85	5.40
Mean.....	4.25	4.37	4.65	4.19
SD.....	0.57	0.59	0.58	0.56

Note. Values were based on the raw score average of all subscale items. Maximum possible score was 6 and the minimum possible score was 1. A higher score indicates stronger positive PSTE and STOE beliefs. In the questionnaire judgments were made on 6-point scales (1 = strongly disagree, 6 = strongly agree)

the other hand, 94% of the Turkish participants agreed with this statement. While more than half of the Turkish participants (64%) believed that the teacher is generally responsible for the achievement of students in science, this percentage was slightly lower in USA sample (46%).

To compare both the PSTE and STOE views of the students, Rasch measures for the two student samples were calculated. This meant that a set of items defining self-efficacy was used to calculate an overall attitudinal measure, and that measure was provided in linear (non raw score units). Also the set of items defining outcome expectancy was used to calculate an overall attitudinal measure, and that measure also was provided in linear units. Then those linear measures (two for each person) were used for parametric tests. First, ANOVA procedures were utilized. First, a 2x2 ANOVA was run on the data using gender and country

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violates measurement assumptions. Wright and Linacre (1991) also mention a number of additional advantages of utilizing the Rasch model: (1) an evaluation is allowed when respondents do not answer every item, (2) measurement errors of survey items and respondents are reported; and (3) idiosyncratic responses of students can be easily detected. Survey data were calibrated by using the BIGSTEPS computer program (Wright & Linacre). Much of the data presented in this study is reported in Rasch log odds units (so called logits), which take into consideration issues of non-linearity. The authors provide appropriate guidance later with regard to the relative meaning of differences between comparison groups expressed in logits. In some tables the raw score is provided to ease understanding for those unfamiliar with logits, but all statistical tests were carried out using the logit measures (as opposed to raw scores) calculated for each respondent.

## Results

A descriptive analysis of student data indicates generally positive self-

efficacy beliefs regarding science teaching in both countries (Table 2). Overall preservice teachers generally had high science teaching outcome expectancy scores, which meant in general, that participants had expectations that their science teaching would influence student science learning.

An initial raw score analysis suggested that about 89% of the participants in USA and 78% of the participants in Turkey had confidence in their ability to teach science effectively. In both countries only about 45% of the participants felt they knew the steps necessary to teach science concepts effectively. Similarly, about 59% of preservice teachers in both countries claimed to understand science concepts well enough to be effective in teaching elementary science.

Respondents also seemed generally willing to assume that student learning in the content area of science is the responsibility of the teacher. About 77% of the participants in the USA sample indicated that good teaching could overcome the inadequacy of a student's science background. On

as independent variables, and the students' PSTE measures were used as the dependent variables. ANOVA results indicated that preservice elementary teachers of the American sample had a significantly higher personal science teaching efficacy measure than the preservice teachers in Turkey,  $F(1,175) = 7.19, p < 0.05$ . This means that these preservice elementary teachers in the United States had significantly more positive beliefs in their own ability to influence student learning in science than their peers in Turkey. Although the difference was statistically significant, the effect size was found to be small (eta squared = .04) There were no significant differences between PSTE scores of female and male preservice teachers neither in the overall data set,  $F(1,175) = 1.11, p = 0.293$ , nor when compared as a function of country,  $F(1,175) = 1.23, p = 0.353$ .

A second 2x2 ANOVA was run with the same independent variables and the logit measures of STOEE (Outcome expectancy) as the dependent variable. This analysis indicated that science teaching outcome expectancy measures of the preservice teachers from the two countries did not differ significantly  $F(1,175) = 0.002, p = .965$ . In other words, the degree to which these preservice teachers believed that their teaching can influence student learning were not significantly different in the two compared countries. The ANOVA results suggest that among these two groups of preservice elementary teachers gender was not a significant factor which could predict the magnitude of one's science teaching outcome expectancy belief  $F(1,175) = 0.264, p = 0.608$ .

To investigate the responses of preservice teachers to each survey item, logit measure of each item in the

questionnaire were computed. Tables 3 and 4 provide the logit measures of the items comprising the PSTE and STOEE scales. In these tables, lower logit measures indicate items which were easier to agree with by the surveyed preservice elementary teachers, and the higher logit measures indicate items which were harder to agree with. The differences in the functioning of items in two countries were also tested. In testing the significance of the difference in item functioning, the alpha level was set to be .004 for PSTE scale items and .005 for STOEE scale items, in order to reduce the probability of type one error. There were several items in PSTE scale that demonstrate statistically significant difference in terms of functioning between the two samples (Table 3).

In the PSTE scale the item which was most easy to agree with in the USA sample involved believing to

Table 3  
Responses of preservice teachers to personal science teaching efficacy items.

Items	USA Measures (logit)	Turkey Measures (logit)	t
Be at lost in helping students with difficulties in understanding science <sup>a</sup> .....	-2.87	-0.05	-9.78*
Not able to effectively monitor science experiments <sup>a</sup> .....	-1.10	-0.21	-3.47*
Not willing to be observed by supervisor while teaching science <sup>a</sup> .....	-0.27	0.49	-3.35*
Know steps to effectively teach science .....	0.12	0.77	-3.06*
Will not likely have necessary skills to teach science <sup>a</sup> .....	0.45	0.47	-0.10
Understand science well enough to be effective in teaching.....	0.50	0.17	1.55
Will not be able to teach science as well as most subjects <sup>a</sup> .....	0.52	-0.01	2.49
Will generally teach science ineffectively <sup>a</sup> .....	0.30	-0.25	2.51
Find it difficult to explain why science experiments work <sup>a</sup> .....	0.45	-0.12	2.68
Welcome students' questions about science.....	-0.03	-0.86	3.56*
Will find better ways to teach science.....	0.28	-0.56	3.71*
Able to answer students' science questions.....	1.65	-0.30	9.46*

Note. Statements of the items were abbreviated for presentation purposes. Higher logit measure indicates the statement's being relatively less easy to agree with. The items are ordered based on t values. Statements relatively easier to agree with in USA sample than the Turkish sample are presented at the top of the table and the statements relatively easier to agree with in Turkish sample than the USA sample are presented towards the bottom part of the table.

<sup>a</sup> Items reversed before scoring

\*p < .004

Table 4

*Responses of preservice teachers to science teaching outcome expectancy items.*

Items	USA Measure (logit)	Turkey Measure (logit)	t
If parents note an increase in the interest in science, it is due to the teacher's performance.....	-0.34	0.24	-2.73
When a student does better than usual in science, it is due to teacher's extra effort. ....	-0.15	0.41	-2.63
Teacher is responsible for student's science achievement.....	-0.01	0.51	-2.62
Improved science grades of students are due to teachers' effective teaching approach.....	-0.78	-0.43	-1.50
The inadequacy of a student's science background can be overcome by good teaching.....	-1.02	-1.01	-0.04
Low science achievement cannot be blamed on teacher. <sup>a</sup> .....	1.15	1.14	0.05
When a low achieving child progresses in science, it is usually due to extra attention given by the teacher.....	0.11	-0.34	2.18
Increased effort in science teaching produces little change in students' science achievement. <sup>a</sup> .....	0.53	0.09	2.20
Underachievement is due to ineffective science teaching.....	0.53	0.00	2.65
Science achievement of a student is directly related to teacher's effectiveness in teaching.....	-0.01	-0.60	2.76

Note. Statements of the items were abbreviated for presentation purposes. Higher logit measure indicates the statement's being relatively less easy to agree with. The items are ordered based on t values. Statements relatively easier to agree with in USA sample than the Turkish sample appears at the top part of the table and the statements relatively easier to agree with in Turkish sample than the USA sample are presented towards the bottom part of the table.

<sup>a</sup> Items reversed before scoring

have “the ability to help students having difficulties in understanding science” (Table 3). This statement had significantly different degrees of agreement in two countries. Preservice teachers in USA agreed with this statement more than their peers in Turkey (Table 3). On the other hand, the statement about being “able to answer students’ science questions” was significantly easier to agree in Turkey than USA.

With respect to the STOE scale, the most easy to agree with and the least agree to with items in both countries were the same. The most agreed item involved whether the inadequacy of a student’s science background can be overcome by good teaching. The least agreed to item, in both countries, was that the low science achievements

of students can be blamed on their teachers. In addition, none of the items in STOE scale had significantly different functioning in two samples (Table 4).

## Discussion

Results from this study indicate that there were differences in personal teaching efficacy beliefs of the USA and Turkish samples of preservice teachers.

In general, USA preservice teachers have stronger personal science teaching efficacy beliefs than Turkish preservice elementary teachers. There were also significant differences on the responses to several individual items in the personal science teaching efficacy scale. For example, preservice teachers in Turkey had significantly

higher beliefs on themselves for welcoming student questions about science or being able to answer students’ science questions. Preservice teachers in USA, on the other hand, had stronger beliefs in themselves to be able to help students with difficulties in understanding science.

There may be various reasons for this difference. Since the instrument was created utilizing samples in USA, it is possible that some statements in the questionnaire are not suitable when applied to differing cultural perspectives. Similarly, Lin and Gorell (2001) suggested that the concept of teacher efficacy may be culturally oriented and thus need to be carefully examined when applied in different cultures. Another reason of such a difference may be the coursework that

preservice teachers in both countries are required to complete. In terms of the amount and the type of courses, there are not clear differences between the two programs. However, pedagogical courses in the teacher education program of the USA may have some differences in terms of the goals and the learning experiences they provide. For example, the pedagogical courses in the Turkish teacher education programs rely generally on the international knowledge base and mostly on the sources are originated from English speaking countries (Çakiroglu & Çakiroglu, 2003). This may result in less relevant understanding of the science teaching issues by the preservice teachers in Turkey, which in turn may bring about lower personal science teaching efficacy beliefs.

Preservice teachers' conceptions of their workplace may also contribute to their personal efficacy beliefs. These beliefs are partly formed through student teaching experiences. Some researchers have suggested that fieldwork may influence preservice teachers' sense of efficacy towards science (Huniker and Madison, 1997; Ramey-Gassert et al., 1996, Crowther & Cannon, 1998). Both of the samples we investigated in this study had not completed the student teaching experiences. However, the preservice teachers in USA completed a field study accompanied with a science teaching methods course. Due to having more student teaching hours, the American preservice teachers may develop a better understanding of the workplace and spend more time on understanding the issues within the education system. This may also help preservice teachers in USA to develop a better sense of efficacy in teaching science.

Another reason of the difference might be the characteristics of the sample of preservice teachers in both countries. Students in both countries enter the teacher education program in a different way. For example, in Turkey students are placed in undergraduate teacher education programs through a nationwide university entrance examination. After taking the exam, students must submit a list of programs which they would like to study in the order of preference. It is sometimes the case that the candidates are placed to teacher education programs as their last choices of profession to study. There is a shared concern among teacher educators in Turkey that some of the candidates of teacher education programs make their decisions by thinking the well-known saying in Turkey: "if you cannot be anything you can at least be a teacher" (Altan, 1998). For that reason, preservice teachers in USA might begin their teacher education program with more specific and determined aims, which in turn may result in different levels of science personal teaching efficacy beliefs.

Interestingly, the science teaching outcome expectancy beliefs of the preservice teachers of both countries were similar. Analysis of Variance

suggested no statistically significant difference in the STOE measures of preservice teachers in the two countries. In addition, a comparison based on individual items indicated no significant differences in their functioning between USA and Turkey. In both samples preservice teachers generally disagreed with the idea that low science achievement can be blamed on teachers. Again both groups of preservice teachers generally agreed with the idea that the inadequacy of a student's science background can be overcome by good teaching. Data collected with this sample of students suggest that the survey items which emphasize a connection between underachievement of students and their teachers' performance, tended to be harder to agree with than the other survey items. The items which emphasized a connection between improvement in student achievement and teacher performance tended to be relatively easier to agree with than the other items in the STOE scale.

It is conceivable that the successful implementation of science education programs may depend on teachers' self-efficacy beliefs, that is, their personal beliefs regarding their ability to teach science and their ability to produce positive outcomes in science for students. Therefore, efficacy beliefs give a measure of the sense of how the preservice teachers perceived their strengths and preparedness as potential science teachers. Due to the vital role preservice teachers will play in educating younger generation, teacher education programs need to evaluate efficacy levels of their teacher education students and begin to find ways to enhance their efficacy beliefs regarding science teaching. Then these teacher education programs can begin

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to launch future teachers who are ready, willing, and able to meet the needs of their students.

Educational research that crosses national boundaries offers much promise for generating new insights because the familiar educational practices, beliefs and attitudes in one country can be exposed and questioned when researchers from two countries collaborate on studies involving teaching and learning (Albridge et al., 1999). While researchers from different cultures practice approaches inherent in their own context, each culture has much to learn from the other. The current study suggested that there may be common experiences and similar self-efficacy beliefs among national and cultural boundaries. Similarities and differences should be explored if we want to expand our knowledge about the development of teachers throughout the world. In such cross cultural comparisons of science teaching efficacy, future research should consider beliefs about science teaching, for an understanding of science teaching—e.g. whether being committed to a more “teacher-centered approach” or “student centered approach” is related to teachers’ belief regarding their effectiveness in science teaching. In addition, parallel longitudinal studies may help one better understand the influence of preservice teacher education programs to prospective teachers across cultures.

### References

- Albridge, J. M., Fraser, B.J., & Huang, T. I. (1999). Investigating classroom environments in Taiwan and Australia with multiple research methods. *The Journal of Educational Research*, 93, 48-62.
- Altan, M.Z. (1998). A call for change and pedagogy: a critical analysis of teacher education in Turkey. *European Journal of Education*, 33, 407-417.
- Ashton, P.T. & Webb, R.B. (1986). *Making a difference: Teacher's sense of efficacy and student achievement*. New York: Longman.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavior change. *Psychological Review*, 84, 191-215.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. New Jersey: Prentice-Hall.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W.H. Freeman & Company.
- Çakiroglu, E. & Çakiroglu, J. (2003). Reflections on Teacher Education in Turkey. *European Journal of Teacher Education*, 26, 253-264.
- Campbell, J. (1996). A comparison of teacher efficacy for pre and in-service teachers in Scotland and America, *Education*, 117, 2-11.
- Crowther, D.T. & Cannon, C.R. (1998). How much is enough? Preparing elementary science teachers through science practicum. In *Proceedings of the Annual International Conference of the Association for the Education of Teachers in Science*, Ruba, P. A., & Rye, J. A. (Eds.) Minneapolis: Association for the Education of Teachers in Science.
- Enochs, L.G, Scharmann, L.C. & Riggs, I.M. (1995). The relationship of pupil control of preservice elementary science teacher self-efficacy and outcome expectancy. *Science Education*, 79, 63-75.
- Enochs, L.G. & Riggs, I.M. (1990). Further development of an elementary science teaching efficacy belief instrument: A preservice elementary scale. *School Science and Mathematics*, 90, 694-706.
- Gibson, S., & Dembo, M. (1984). Teacher efficacy: A construct validation. *Journal of Educational Psychology*, 76, 569-582.
- Gorrell, J., & Hwang, Y.S. (1995). A study of self-efficacy beliefs among preservice teachers in Korea. *Journal of Research and Development in Education*, 28, 101-105.
- Gorrell, J., Hazareesingh, N.A., Carlson, H.L., & Stenmalm-Sjoblom, L.S. (1993). A comparison of efficacy beliefs among preservice teachers in the United States, Sweden and Sri Lanka. Paper presented at the meeting of the American Psychological Association, Toronto, Canada.
- Green K. E. (1996). Applications of the Rasch model to evaluation of survey data quality. In *Advances in Survey Research*, Bravermann, M.T and Slater, J.K. (Eds.). New Jersey: Jossey-Bass Publishers.
- Henson, R. K. (2001). Teacher self-efficacy: Substantive implication and measurement dilemmas. Paper presented at the annual meeting of the Educational Research Exchange, Texas.
- Huinker, D., & Madison, S.K. (1997). Preparing Efficacious elementary teachers in science and mathematics: The influence of methods courses. *Journal of Science Teacher Education*, 8, 107-126.
- Lin, H. & Gorrell, J. (2001). Exploratory analysis of pre-service teacher efficacy in Taiwan. *Teaching and Teacher Education*, 17, 623-635.
- Lin, H., Gorrell, J. & Taylor, J. (2002). Influence of culture and education on U.S. and Taiwan preservice teachers' efficacy beliefs. *The Journal of Educational Research*, 96, 37-46.
- Ramey-Gassert, L., Shroyer, M.G. & Staver, J.R. (1996). A qualitative study of factors influencing science teaching self-efficacy of elementary level teachers. *Science Education*, 80, 283-315.
- Rich, Y., Lev, S., & Fisher, S. (1996). Extending the concept and assessment of teacher efficacy. *Educational and Psychological Measurement*, 56, 1015-1025.

- Riggs, I. M. (1991). Gender differences in primary science teacher-efficacy. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL.
- Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs*, 80, 1-28.
- Simsek, H. & Yildirim, A. (2001). The reform of pre-service teacher education in Turkey. In *Challenge and Change in the Euro-Mediterranean Region*, Sultana, R. G. (Ed.). New York: Peter Lang.
- Tschannen-Moran, M., Woolfolk-Hoy, A & Hoy, W.K. (1998). Teacher Efficacy: Its Meaning and Measure. *Review of Educational Research*, 68, 202-48.
- Tschannen-Moran, M., Woolfolk-Hoy, A (2001). Teacher efficacy: capturing an elusive construct. *Teaching and Teacher Education*, 17, 783-805.
- Woolfolk, A.E. & Hoy, W.K. (1990). Prospective teachers' sense of efficacy and beliefs about control. *Journal of Educational Psychology*, 82, 81-91.
- Wright, B.D. And Linacre, J.M. (1991). *Bigsteps computer program*. Chicago: Mesa Press.
- Yeung, K., & Watkins, D. (2000). Hong Kong student teachers' personal construction of teaching efficacy. *Educational Psychology*, 20, 213-236.
- YÖK (1998). Eitim Fakultesi Ogretmen Yetistirme Lisans Programlari. Retrieved September 30, 2003, from <[http://www.yok.gov.tr/egitim/ogretmen/ogretmen\\_yetistirme\\_lisans/giris.pdf](http://www.yok.gov.tr/egitim/ogretmen/ogretmen_yetistirme_lisans/giris.pdf)>.
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