DOCUMENT RESUME

ED 340 705 SP 033 522

AUTHOR Riggs, Iris M.
TITLE Gender Differences in Elementary Science Teacher Self-Efficacy.
PUB DATE Apr 91
NOTE 13p.; Paper presented at the Annual Meeting of the American Educational Research Association (Chicago, IL, April 3-7, 1991).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Elementary Education; Elementary School Teachers; *Equal Education; Higher Education; Inservice Teacher Education; Methods Courses; Nondiscriminatory Education; Preservice Teacher Education; *Science Education; Science Teachers; *Self Efficacy; *Sex Differences; Sex Fairness; *Teacher Attitudes; *Teacher Effectiveness; Womens Education
IDENTIFIERS *Reflective Analysis

ABSTRACT

The purpose of the study described here was to examine gender as it affects elementary-school teacher attitudes towards teaching science. The Science Teaching Efficacy Belief Instrument (STEBI) was employed to measure the self-efficacy and outcome expectancy beliefs of elementary preservice and inservice teachers. Due to the experience of females in society and in schools, it was hypothesized that they would have lower science teaching self-efficacy beliefs than their male counterparts. This hypothesis was tested on two independent samples: a sample of practicing elementary teachers from both rural and urban school districts (N=331) and a sample of rural and urban preservice teachers (N=210). The results revealed significantly higher scores for males on self-efficacy for science teaching in both inservice and preservice samples. No significant differences were obtained for outcome expectancy scores. Findings suggest that methods courses in teacher education programs focus on preservice teachers' own experiences with science and past education inequities. Potential teachers' reflections regarding gender equity and their own educational experiences need to be addressed in order to close the gender efficacy gap and enable all teachers to approach science teaching with the same vigor. (LL)

# Gender Differences in Elementary Science Teacher Self-efficacy

Iris M. Riggs

California State University, San Bernardino

Paper presented at the annual meeting of the

American Educational Research Association

April 3, 1991

Chicago, Illinois

Introduction

As reported by the National Science Foundation, only 22% of all elementary teachers felt "very well qualified to teach science" (1980, P.3). This perceived lack of preparation is often connected to the limited amount of time devoted to the elementary science curriculum (Fitch & Fisher, 1979; Weiss, 1978). Teachers with little science preparation may develop a negative attitude toward science and, therefore, avoid its teaching.

Teacher attitude has also been reported to affect the attitude and/or performance of students (Baker, 1990; Ramsey & Howe, 1969). It would seem that negative attitude may be communicated to students through the science instruction that is conducted. Nonverbal messages may also communicate that science is not important or liked, especially if it is not taught on a regular basis.

At the elementary level, teachers are most often female. They are therefore products of a society and educational system which may not have prepared them as well as their male counterparts for the teaching of science. Few studies, though, have investigated gender differences in elementary teachers. One such study of teachers' attitudes toward science and science instruction by Levin & Jones (1983) reported male elementary teachers had a significantly more positive attitude toward science teaching. Those female teachers who ranked science as a low instructional priority had the least positive attitude toward

science.

Findings reported by Taiwo (1980) found males to have a significantly more positive attitude toward science teaching than did females ($t$ = 4.72, $p < .01$). Even when controlling for previous exposure to science education, males came out ahead. Thus, the conclusion was made, "...one's gender is related more to the degree of favorableness of one's attitude toward science teaching than to previous exposure to science education" (p. 319).

The present study expands upon the previous findings by utilizing the Science Teaching Efficacy Belief Instrument (Riggs, 1988) to measure the self-efficacy and outcome expectancy beliefs of elementary pre- and inservice teachers. Self-efficacy beliefs have been closely linked to behavior in Bandura's theory of social learning behavior (1977). Bandura suggested that people develop a generalized expectancy about action-outcome contingencies based upon life experiences (outcome expectancy). Additionally, they develop specific beliefs concerning their own coping abilities (self-efficacy). Behavior, for Bandura, was based upon both factors. Behavior is enacted when people not only expect certain behaviors to produce desirable outcomes, but when they also believe in their own ability to perform the necessary behaviors.

In the study of science teaching efficacy beliefs, one might apply this theory to predict that teachers who believe that science learning can be influenced by effective science teaching (outcome expectancy) and who believe in their own ability to

effectively teach science (self-efficacy) will more regularly and effectively teach science. This relationship of teaching beliefs to behavior was presented in Gibson & Dembo's study of general teacher self-efficacy (1984). This relationship of teacher beliefs and behavior to teacher attitude is further illuminated in an example provided by Koballa & Crawley (1985) and revised to fit the elementary science experience by Riggs (1988).

> 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 avoids teaching science if at all possible (behavior).

Method

Due to the experience of females in society and the schools, it was predicted that female elementary pre- and inservice teachers would have lower science teaching self-efficacy beliefs than their male counterparts as measured by the Science Teaching Efficacy Belief Instrument (STEBI). This hypothesis was tested on two independent samples: a sample of practicing elementary teachers from both rural and urban school districts (N=331) and a sample of rural and urban preservice teachers (N=210).

The STEBI contains two scales developed to measure Bandura's theoretical constructs of efficacy beliefs and outcome expectancy beliefs in reference to elementary teachers' science teaching behaviors (See Appendix A). Good reliability and validity have been previously established for an inservice and preservice version of the scale (Riggs & Enochs, 1990; Enochs & Riggs, 1990).

## Results

As predicted, *t*-tests revealed significantly higher scores for males on self-efficacy for science teaching in both the inservice and preservice samples (Table 1). No significant differences were obtained for outcome expectancy scores.

---

Insert Table 1

---

## Discussion

This finding gives cause for concern. Science has been advocated as a priority for all students at all grade levels. The elementary teacher appears to be central to the amount of time devoted to elementary science and the resulting attitude and achievement level of elementary students. Self-efficacy beliefs, which are proposed as the foundation upon which attitudes and behaviors are based, appear to be lower for the majority of elementary teachers--females.

This finding raises many questions for further investigation. What is the cause of this gender difference? Might it be explained by the female teachers' own lack of background in science? Unfortunately, the present study did not control for this variable. However, as previously cited, some researchers have found this variable to be insignificant. Perhaps the reason for this lies within the different experiences males and females can encounter within the same classroom. For example, in their study of teacher-student interactions, the Sadkers (1986) found both the quality and quantity of classroom

interactions to be inequitable, with male students typically receiving more specific feedback from the teacher. This trend seems to follow female students from the elementary years through college. The result appears to be lower self-esteem for females (Astin, 1977).

Or perhaps the difference is related to females' tendency to attribute success to outside factors rather than personal ability (Deaux & Miller, 1974). The impact of attribution theory on teachers' self-reported efficacy might be investigated through assessment of males' and females' efficacy beliefs in more than one content area. Do female teachers consistently report lower self-efficacy, even in the teaching of reading, language arts, social studies, etc.? If so, researchers need to investigate the potential gender differences in self-efficacy, teaching effectiveness and the relationship of self-efficacy to teaching effectiveness in all content areas.

The difference may also lie within the self-efficacy ratings of the male teachers. Perhaps the higher science self-ratings are due to the higher expectations put upon male teachers by those around them. As one male teacher stated, "...I have 63 hours of social studies classes and have never taught social studies in 15 years of teaching..." It seems that oftentimes, it is assumed that the few male teachers in the elementary setting are the most effective science teacher/leaders. Whether their training supports that thesis or not, they are often thrust into the role of science coordinator for the school. This practice may lead to a self-fulfilling prophecy in that the male teachers

end up viewing themselves as science teaching experts.

With regard to preservice methods courses, the question of preservice candidates' own experiences with science and past educational inequities might also be addressed. Oftentimes, gender equity is only referred to within these courses in reference to the elementary student. It might be wise to also devote time to these potential teachers' reflections regarding their own educational experiences and those experiences' possible relationships to the teachers' present beliefs and attitudes.

The STEBI might prove useful to help both pre- and inservice teachers clarify their beliefs and to develop an organized conception of how these beliefs might be represented in behavior. This activity may increase the relationship between self-efficacy beliefs and teachers' behavior (Ashton, 1984). Such self-analysis might, in and of itself, serve as inservice or preservice training for elementary and preservice teachers.

It is interesting to note that no gender differences were apparent in outcome expectancy beliefs. While female teachers tend to report less belief in their own ability to teach science, they were as positive as males that good teaching would result in student learning. Unfortunately, outcome expectancy alone is not adequate to motivate science teaching. Although teachers with high outcome expectancy believe students can learn from effective science teaching, they may view science teaching as a waste of time if they believe themselves incapable of doing it effectively. The gender efficacy gap must be closed before all teachers will approach science teaching with the same vigor.

## REFERENCES


Ashton, P. (1984). Teacher efficacy: A motivational paradigm for effective teacher education. Journal of Teacher Education, 35, 28-32.

Astin, A. (1977). Four critical years: Effects of college on beliefs, attitudes, and knowledge. San Francisco: Jossey-Bass.

Baker, D. (1990). Gender differences in science: Where they start and where they go. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Atlanta.

Bandura, A. (1977). Self efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84, 191-215.

Deaux, K. & Emswiller, T. (1974). Explanation of successful performance: What's skill for the male is luck for the female. Journal of Personality and Social Psychology, 29, 80-85.

Enochs, L. & Riggs, I. (1990). Further development of an elementary science teaching efficacy belief instrument: A preservice elementary scale. Accepted for publication in School Science and Mathematics.

Fitch, T. & Fisher, R. (1979). Survey of science education in a sample of Illinois schools: Grades K-6 (1975-1976). Science Education, 63, 407.

Gibson, S., & Dembo, M. (1984). Teacher efficacy: A construct validation. Journal of Educational Psychology, 76, 569-582.

Koballa, T. & Crawley, F. (1985). The influence of attitude on science teaching and learning. School Science and Mathematics, 85, 222-232.

Levin, J. & Jones, C. (April, 1983). Elementary teachers' attitudes toward science in four areas related to gender differences in students' science performance. Paper presented at the annual meeting of the American Educational Research Association, Montreal.

National Science Foundation. Science Education Databook, SE80-3. Directorate for Science Education.

Ramsay, G. & Howe, R. (1969). An analysis of research related to instructional procedures in elementary science. Science and Children, 6, 25-36.

Riggs, I. (1988). The development of an elementary teachers' science teaching efficacy belief instrument. Unpublished Ph.D. dissertation, Kansas State University, 1988.

Riggs, I. & Enochs, L. (1990). Toward the development of an elementary teachers' science teaching efficacy belief instrument. Science Education, 74.

Sadker, M. & Sadker, D. (1986). Sexism in the classroom. From grade school to graduate school. Phi Delta Kappan, 67, 512-515.

Weiss, I. (1978). Report of the 1977 national survey of science, mathematics and social studies education. Washington, D.C.: U.S. Government Printing Office.

Table 1 - Breakdown of Self-Efficacy and Outcome Expectancy Scale Scores by Gender

| Variable | N | % | MEAN SESCALE | MEAN OESCALE |
|---|---|---|---|---|
| Inservice | | | | |
| Females | 288 | 88% | 55.48 (9.32) | 49.41 (5.84) |
| Males | 39 | 12% | 58.90 (7.27) | 50.10 (6.03) |
| | | | $t$ = 2.19* | $t$ = .69 |
| Preservice | | | | |
| Females | 184 | 87% | 46.51 (7.80) | 42.81 (5.77) |
| Males | 27 | 13% | 50.19 (6.59) | 42.85 (3.94) |
| | | | $t$ = 2.32* | $t$ = .03 |

* Significantly different at the .05 level

Appendix A

Inservice Version

1. When a student does better than usual in science, it is often because the teacher exerted a little extra effort.
2. I am continually finding better ways to teach science.
3. Even when I try very hard, I do not teach science as well as I do most subjects.
4. When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.
5. I know the steps necessary to teach science concepts effectively.
6. I am not very effective in monitoring science experiments.
7. If students are underachieving in science, it is most likely due to ineffective science teaching.
8. I generally teach science ineffectively.
9. The inadequacy of a student's science background can be overcome by good teaching.
10. The low science achievement of some students cannot generally be blamed on their teachers.
11. When a low=achieving child progresses in science, it is usually due to extra attention given by the teacher.
12. I understand science concepts well enough to be effective in teaching elementary science.
13. Increased effort in science teaching produces little change in some students' science achievement.
14. The teacher is generally responsible for the achievement of students in science.
15. Students' achievement in science is directly related to their teacher's effectiveness in science teaching.
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.
17. I find it difficult to explain to students why science experiments work.
18. I am typically able to answer students' science questions.
19. I wonder if I have the necessary skills to teach science.
20. Effectiveness in science teaching has little influence on the achievement of students with low motivation.
21. Given a choice, I would not invite the principal to evaluate my science teaching.
22. When a student has difficulty understanding a science concept, I am usually at a loss as to how to help the student understand it better.
23. When teaching science, I usually welcome student questions.
24. I do not know what to do to turn students on to science.
25. Even teachers with good science teaching abilities cannot help some kids to learn science.

Preservice Version

1. When a student does better than usual in science, it is often because the teacher exerted a little extra effort.
2. I will continually finding better ways to teach science.
3. Even when I try very hard, I will not teach science as well as I will most subjects.
4. When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.
5. I know the steps necessary to teach science concepts effectively.
6. I will not be very effective in monitoring science experiments.
7. If students are underachieving in science, it is most likely due to ineffective science teaching.
8. I will generally teach science ineffectively.
9. The inadequacy of a student's science background can be overcome by good teaching.
10. The low science achievement of some students cannot generally be blamed on their teachers.
11. When a low-achieving child progresses in science, it is usually due to extra attention given by the teacher.
12. I understand science concepts well enough to be effective in teaching elementary science.
13. Increased effort in science teaching produces little change in some students' science achievement.
14. The teacher is generally responsible for the achievement of students in science.
15. Students' achievement in science is directly related to their teacher's effectiveness in science teaching.
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.
17. I will find it difficult to explain to students why science experiments work.
18. I will typically be able to answer students' science questions.
19. I wonder if I will have the necessary skills to teach science.
20. Given a choice, I will not invite the principal to evaluate my science teaching.
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.
22. When teaching science, I will usually welcome student questions.
23. I do not know what to do to turn students on to science.