DOCUMENT RESUME

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|---|---|---|
| ED 418 854 | | SE 061 319 |
| AUTHOR | Pontius, Richard | |
| TITLE | Correlation Analysis and Comparison of Two Self-Efficacy Instruments. | |
| PUB DATE | 1998-04-00 | |
| NOTE | 13p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (71st, San Diego, CA, April 19-22, 1998). | |
| PUB TYPE | Reports - Research (143) -- Speeches/Meeting Papers (150) | |
| EDRS PRICE | MF01/PC01 Plus Postage. | |
| DESCRIPTORS | *Attitudes; *Elementary School Teachers; Expectation; Higher Education; Likert Scales; *Preservice Teacher Education; Science Education; Science Teachers; Self Concept Measures; *Self Efficacy; *Self Evaluation (Individuals); Success | |

ABSTRACT

Belief in the ability to teach or to teach a particular subject can help fuel success in the first stages of a teaching career. The need for a reliable instrument with which to probe preservice elementary teachers' self-efficacy beliefs in the teaching of science led to the development of two versions of a teacher efficacy scale that were tested in this study: the Teacher Efficacy Scale as modified by Kushner (1993), and the Science Teaching Efficacy Belief Instrument Form B (STEBI B) developed by Enochs and Riggs (1990). The two instruments were given to students in an elementary science methods course during the first 2 or 3 weeks of the semester. Typically students in this class were within a semester or two of student teaching. Both instruments were modifications of other instruments and the evolution of each is described. Both instruments used a Likert-type scale. The nature of this study suggested that a positive correlation might exist between the analogous scales of the two instruments. In both cases the correlation was negative. Preservice teachers with high personal efficacy tended to have lower science teaching efficacy, and those with high science teaching efficacy tended to have lower general teaching efficacy. Possible reasons for these results are discussed. (PVD)

# Correlation Analysis and Comparison of Two Self-Efficacy Instruments

by

Richard Pontius

UM-St. Louis

Presented to the National Association for Research in Science Teaching
Annual Conference
San Diego, CA
April 19-22

Self-efficacy, or one's belief in one's abilities to perform a particular behavior, has implications for preservice and beginning teachers who may have had limited experience with students. Belief one's ability to teach or teach a particular subject can help fuel success in the first stages of a teaching career.

Bandura (1977), proposed a theory of self efficacy leading to behavioral change. He hypothesized 2 factors in his model. The first factor consisted of efficacy expectations. These develop from of an individual's belief that he or she is capable of performing a given behavior. The second aspect of Bandura's theory is that of outcome expectations. The belief that performing a specific behavior will result in a desirable outcome is the basis for outcome expectations. Thus, outcome expectations may be negative in spite of positive efficacy expectations. The individual may believe themselves capable of performing a given behavior, but in the end may not believe that performing the behavior will lead to the desired outcome. Conversely, an individual may believe that a given behavior will cause a specific outcome, but doubt the personal ability to perform such a behavior. The desired situation is for the individual to believe both that he or she can perform the behavior and that such behavior will produce the desired outcome.

Bandura also points out that neither efficacy expectations nor efficacy outcomes are fixed values and may function along a continuous range of values. For example, one's belief in the ability to perform a given behavior is influenced by the perception of difficulty of that behavior. Walking across a level floor will probably be perceived by most as an easy behavior to attain and therefore have a high efficacy expectation. On the other hand walking across a wire strung between two points will likely be perceived as much more difficult and with that perception the efficacy expectation will almost certainly be lower.

Citing research from others on the importance of teacher efficacy, Gibson and Dembo (1984) developed the Teacher Efficacy Scale. Through factor analysis they noted the accuracy of Bandura's 2-factor construct of efficacy for teachers. Items they found grouped in Factor 1 related to the the teachers' belief in personal responsibility for students' learning. They labeled this item "Personal Teaching Efficacy" which corresponded with Bandura's self-efficacy dimension. The second factor related to the teachers' belief in personal ability to bring about change regardless of external factors and was congruous with Bandura's outcome expectancy construct.

Working with prospective teachers Woolfolk and Hoy (1990) used a modified version of the Teacher Efficacy Scale developed by Gibson and Dembo. Items that produced adequate reliability were retained in the new instrument while some other items were eliminated. Several additional items were included as well. This study reconfirmed the two factor facet of teacher efficacy.

Looking at the Teacher Efficacy Scale, Hoy and Woolfolk (1990) and

Woolfolk and Hoy (1990) commented that the factor categorized as an outcome expectation by Gibson and Dembo appeared to be an additional efficacy expectation rather than an outcome expectation. Their rationale came from the idea that the ability of teaching to counteract student background factors was an expectation not an outcome. Gusky and Passaro (1994) noted two factors of efficacy on the instrument, but noted that the factors appeared to conform more to an internal and an external locus-of-control with the construct labeled personal efficacy appearing to be related to an internal locus of control. They commented that while apparently relationship existed it was not a straight locus-of-control relationship.

Kushner (1993) further modified the instrument used by Woolfolk and Hoy to make it more in tune with the needs of preservice teachers. In this study Kushner reconfirmed the two factor nature of the efficacy construct postulated by Bandura.

In the area of science education, working from the Teacher Efficacy Scale developed by Gibson and Dembo for general teaching efficacy, Riggs and Enochs (1990) evolved the 25-item Science Teaching Efficacy Beliefs Instrument (STEBI). The STEBI was designed to investigate the science teaching efficacy beliefs of elementary classroom teachers. In developing this instrument Riggs and Enochs maintained Bandura's two construct approach to efficacy, self-efficacy and outcome expectancy beliefs. After additional work they concluded that the STEBI was "... a valid and reliable tool for studying elementary teachers' beliefs towards science teaching and learning."

The need for a reliable instrument to probe preservice elementary teachers' self-efficacy beliefs in the teaching of science prompted Enochs and Riggs (1990) to modify the STEBI A for preservice elementary teachers. The result was the Science Teaching Efficacy Belief Instrument Form B (STEBI B). The STEBI B resulted from rewording the STEBI A items to the future tense to reflect the anticipatory nature of preservice teachers. Subsequent testing led to the deletion of two items from the instrument resulting in the STEBI B having two fewer items than the A version.

## Purpose of Study

This study was part of a larger study examining changes in teaching efficacy and science teaching efficacy beliefs resulting from a one-semester course in science methods. Considering that both instruments used in the study were permutations of the Teacher Efficacy Scale developed by Gibson and Dembo a logical question appeared to be whether or not they would correlate strongly due to the common ancestry of the instruments or possibly for some other reason. This also involves potential confounding factors such as the relationship between science teaching efficacy and general teaching efficacy.

## Methodology

The two instruments used in the study were a version of the Teacher Efficacy Scale as modified by Kushner (1993) and the Science Teaching Efficacy Belief Instrument Form B (STEBI B) developed by Enochs and Riggs (1990). Both instruments were modifications of other instruments. The evolution of each was described earlier in the paper. Modifications were done to increase the usability with preservice teachers. Both instruments used a Likert-type Scale. Since the desire was to replicate the format used by Kushner and Enochs and Riggs the modified Science Teaching Efficacy Scale used a six answer forced choice scale as applied by Kushner while the STEBI B employed the five answer forced choice scale used by Enochs and Riggs. A single answer form was used with each administration of the instruments.

The instruments were given to students in an elementary science methods class during the first two or three weeks of the semester. This occurred over three semesters and one summer session. This time was picked rather than the first day in the hope that students would be more relaxed and as a result would report responses accurately. Typically, students in this class were within a semester or two of student teaching and as such tended to be juniors, seniors and graduate students working toward certification. Student participation in this research was strictly voluntary and all were assured that results for individuals would be kept confidential.

The instruments were given to 206 students resulting in approximately 195 usable forms. Several students failed to complete the form, therefore those forms were discarded. Later, responses were tallied on a separate form and the data entered into a spreadsheet for analysis. Statistical analysis was done using SPSS. As might be expected in an elementary education course the group was not divided evenly by gender having 166 female students and 29 male students.

## Results

The alpha reliabilities for the two scales from the modified Teacher Efficacy Scale, Personal Efficacy Scale (PESCALE) and Teaching Efficacy Scale (TESCALE) were 0.79 and .65 respectively. These matched alpha reliabilities of Kushner's first test exactly, but were slightly lower than the 0.84 and 0.70 Kushner achieved on a subsequent administration of the instrument. Didham and Pontius (1998) found reliabilities of 0.74 and 0.56 respectively on the PESCALE and TESCALE.

Alpha reliability results on the STEBI B were as follows. Alpha reliability of the Personal Science Teaching Efficacy Scale (PSTES) was .88 and on the Science Teaching Outcome Expectancy Scale (STOES) .67. The alpha for the Personal Science Teaching Efficacy Scale was comparable with the .90 reported by Enochs and Riggs. However, the reliability of the Science Teaching Outcome Expectancy Scale in this study at .67 was somewhat lower than the .76 reported by Enochs and Riggs. The lower reliabilities on the Science Teaching Outcome Expectancy Scale compared to the Personal Science Teaching Efficacy Scale were also reported by previous researchers.

The nature of the study suggested a positive correlation between the analogous scales of the two instruments might exist. Expectations were that the PESCALE would exhibit some degree of correlation with the Personal Science Teaching Efficacy Scale and the TESCALE would show a degree of correlation with the Science Teaching Outcome Expectancy Scale. Table 1 shows the results of correlations run on the four scales.

Table 1

-- Correlation Coefficients --

| | PSTES | STOES | PESCALE | TESCALE |
|---|---|---|---|---|
| PSTES | 1.0000 | .0679 | -.3251** | -.1733* |
| STOES | .0679 | 1.0000 | -.4051** | -.0797 |
| PESCALE | -.3251** | -.4051** | 1.0000 | .1613* |
| TESCALE | -.1733* | -.0797 | .1613* | 1.0000 |

* - Signif. p= .05   ** - Signif. p= .01   (2-tailed)

In both cases the correlation was negative. The correlation between the PESCALE and the Personal Science Teaching Efficacy Scale was -.325 and was significant at the p= .01 level. The correlation between the TESCALE and the Science Teaching Outcome Expectancy Scale was -.08 but was not statistically significant at the p= .05 level suggesting little correlation.

T-tests for each scale indicated no significant differences based on gender for mean efficacy scores.

## Discussion

The highly significant negative correlation of the Personal Science Teaching Efficacy Scale and the TESCALE was a surprise. The anticipation of a degree of correlation between the two scales was partly due to the perception of commonality of teaching skills between science and other elementary curriculum subjects and partly to the expectation that the instruments might not distinguish well between science and other subjects. The negative correlation suggests that this is not the case. Preservice teachers with high personal efficacy tended to have lower science teaching efficacy and those with high science teaching efficacy tended to have lower general teaching efficacy.

The reasons for this are not readily obvious. Since this was the beginning of the science methods course it may be that students with strong science backgrounds felt quite efficacious about science but less so about other subjects resulting in the high science teaching efficacy scores relative to general efficacy scores. Conversely students with some methods classes might feel more efficacious across the teaching spectrum, but perceive themselves as weaker in science teaching prior to a methods class.

One would expect that the teaching behaviors required for teaching science would be similar to behaviors for teaching other subjects. Perhaps the perception that science is primarily a fact-based course contributes to the low efficacy in many students. This may suggest that subject knowledge is more important to preservice teachers than pedagogical knowledge.

The lack of significant correlation in the second set of scales is not surprising considering the different conceptualizations of scale what the scale means. Additional research might help create a better definition of what this scale is measuring or possibly a reworking of the scale for better definition and reliability.

Two questions that come up are whether or not this will replicate with other groups of preservice teachers and is this only typical of preservice teachers or might it be typical of teachers in general? Potentially, if differences in efficacy between science teaching and teaching in general hold true across a broad spectrum of elementary teachers there may be major implications for teaching. Does efficacy vary from subject to subject independent of general teaching efficacy? What experiences contribute to building a broad sense of efficacy in teachers?

Potential future research in this field should include replication of this study to investigate its validity with other preservice populations. Along with such a study, qualitative research looking into the origins of efficacy differences in the subject fields might shed additional light in this area.

If this pattern replicates in successive groups of future teachers investigation should be done to find out if the same pattern is true for experienced teachers. If so, broader research might be called for to examine relationships between general teaching efficacy, science teaching efficacy, and efficacy in other subject areas.

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