Teaching Problem Solving Skills to Educationally At-Risk High School Students

Julie Morton, Ron Tamborini, and Paul Skalski

Abstract

The current study examined processes relating problem-solving skills training to the performance of adolescent educationally at-risk students. This study began with a model based on the belief that both educational-risk level and problem solving skills training would influence behavioral efficacy and attempted to investigate processes related to locus of control and self-efficacy that underlie this influence. A quasi experiment first varied the problem solving skills training (trained, not trained) at different levels of student educationally at-risk students (at-risk, non-risk) and then measured problem-solving cognitive skill, locus of control, self-efficacy, and behavioral outcome efficacy on a sample of 88 students. Separate models for at-risk and non-risk students evolved. Models for both groups represent a process in which problem solving skills training influences locus of control (positively for at-risk but not positively for non-risk students) which then increases self-efficacy and subsequent behavioral outcome efficacy.

Teaching Problem Solving Skills to Educationally At-Risk High School Students

Educationally at-risk students are young people who have a statistically high probability of encountering failure, attrition or inadequacies with regard to their formal academic education. They constitute an ever-growing problem in society; potentially, in part, due to deficiencies in their ability to solve acute and/or chronic problems in their life. Studies demonstrate that the problem solving attempts of at-risk students lack logical development, thoroughness and sufficient effort (Blum & Spangehl, 1982). Further, "their impulsive, unsystematic [problem solving] styles consistently create more problems than they solve" (McCluskey, Place, McCluskey, & Treffinger, 1998, p 3).

The problem solving deficiencies of educationally at-risk students seem to coexist with an external locus of control (Houtz, Ringenback & Feldhousen, 1973). At-risk students maintain the belief that they are victims of fate, or that attaining desired goals and rewards depends upon luck, circumstance or powerful others rather than upon their own efforts. By contrast, people with an internal locus of control believe that they control their own destinies and are responsible for what happens to them. Notably, people high on internal locus are better problem solvers (Houtz et. al, 1973), and external locus is associated with academic failure (Findley & Cooper, 1983).

Nowicki and Barnes (1973) demonstrated that through experience, it is possible to transform an orientation from an external to an internal locus of control. They did so by providing students repeatedly with objective opportunities where could see that they were personally responsible for their own successes. The mastery of certain problem solving skill sets offers the same type of specific, comprehensible and utilizable skill sets that can change a control orientation. Moreover, since the most commonly stated reason for dropping out of school is poor academic performance (Hahn, 1987; Pallas, 1990), mastering such problem-solving skills may not only help to change the control orientation, it may also reduce the overall risk some students

experience by increasing their ability to negotiate and resolve some of the problems that confront them in life. The present study attempts to investigate issues relating problem-solving skills to the performance of at-risk students. It began with the belief that problem solving skills training could enhance locus of control and self-efficacy, and produce beneficial behavioral outcomes.

Intervention Strategies for At-Risk Students

Educationally at-risk students are comprised of individuals who perform below grade level expectation, study at modified or basic levels, fail to master foundation skills, and are disengaged or have poor attendance.   While exact attrition numbers are difficult to establish, the national graduation rate for 2001 (the most recent year for which statistics were available) shows that nearly one-third of all public high school students failed to graduate (Swanson, 2004).The most commonly stated reason for dropping out is poor academic performance (Hahn, 1987; Pallas, 1990), but regardless of the impetus for leave-taking, the consequence of a student dropping out of the educational system prior to completing high school can be severe. High-school dropouts are more likely to experience: unemployment; diminished earning potential, (US Department of Education [USDE], 1999); increased needs for public assistance (USDE, 1998); parenthood at younger ages; single parenthood (McMillen & Kaufmann, 1996); and incarceration (Harlow, 1996).

Intervention programs aimed at-risk students have existed since the 1930s. Traditionally, these programs have addressed remedial skills, special education, counseling, and internal and external factors affecting the at-risk student. Yet despite the best of educator intentions, many academic institutions have dealt ineffectively with educationally at-risk students. At one extreme, schools process ill-equipped students through the system. It is estimated that since 1983 over 10 million Americans have reached the 12th grade without learning to read at a basic level (Office of Educational Research and Improvement, 1999). At the other extreme, schools make children

repeat a grade in the hope of strengthening their core knowledge base. This approach continues despite empirical findings that students who repeat grades are up to four times more likely to drop out than those who have been promoted (Hahn, 1987). A third approach places at-risk students in academic programs apart from the mainstream, a method that can also have devastating unintended outcomes for students (Hallinan, 1987; Gamoran & Berends, 1987).

Of course, academic institutions do not always deal ineffectively with at-risk students, nor are all at-risk students educationally challenged, or experiencing academic failure. The current paper focuses on the potential efficacy of interventions designed to teach problem-solving skills to at-risk students. This approach is expected to have the added benefit of modifying a student's "locus of control," or belief that they control their own destiny. In this manner, teaching at-risk students to become better problem solvers should allow students to: (1) become cognizant that they not only have the skills, but also the ability, to control (at least parts of) the world around them; and (2) use the knowledge of both their new skill base, and their modified locus of control, to begin to effectively deal with their myriad life problems. These expectations are consistent with research by Wege and Moller's (1995) showing that problem solving training was a positive predictor of internal control orientation, self-efficacy, and quality of problem solutions observed in children initially low on problem solving skills. Indeed, the relationship between problem solving cognitive skills and the deployment of problem solving behavior is indicated in several studies (e.g., Tellado, 1984; McCluskey, Baker, O'Hagan, & Treffinger; 1998, Avarello, 1993). However, these investigations look at outcomes without testing the processes.

The present study tests a model designed to investigate essential processes relating problem-solving skills, control orientation, and self-efficacy to the performance of at-risk students. The model begins with two direct paths predicting that skills training will increase both problem solving cognitive skills and self-efficacy, both of which will go on to increase behavior

outcome efficacy. The model also posits positive paths from the acquisition of problem solving cognitive skills to increased locus of control, and from locus of control to behavior outcome efficacy. Thus, the model predicts that problem solving skills training will increase behavior outcome efficacy through its influence on locus of control and self-efficacy. Finally, the model predicts that educational risk will diminish self-efficacy and problem solving cognitive skills. As such, educational risk is expected to diminish behavioral outcome efficacy indirectly through these same variables.

<div align="center">INSERT FIGURE 1 ABOUT HERE</div>

Rationale for the Model

The most uncomplicated route of influence in this model posits that problem solving skills training[1] will have direct positive effect on the acquisition of problem solving cognitive skills and, through its affect on these skills, an indirect influence on behavior outcome efficacy. The direct path from problem solving skills training to the acquisition of problem solving cognitive skills is well supported by research showing that programs designed to enhance problem-solving techniques can cultivate these cognitive skills (Guilford, 1967; Heppner & Petersen, 1982). Similarly, several studies have demonstrated the relationship predicted for problem-solving skills and behavior efficacy in children (Tellado, 1984), school drop-outs (McCluskey, Baker et al., 1998), and at-risk university students (Avarello, 1993). Students with problem-solving skills are expected to exhibit an increased ability to resolve personal and/or academic problems (behavioral outcome efficacy).

Though paths in this model describing the influence of locus of control and self-efficacy on behavioral outcomes may be less well substantiated than direct influence of cognitive skills and training, there is support for these predictions. The influence of both self-efficacy and locus of control are two of the core features of the model.

Locus of control. The model indicates that problem solving cognitive skills can influence behavior outcome efficacy not only directly, but indirectly through its influence on locus of control. According to Rotter (1966) locus of control is a trait representing the degree to which we believe that we can effect the environment through our own behavior. As a construct, locus of control is particularly pertinent to at-risk students. Observations on this population have repeatedly shown a belief that success experienced in life is a result of external circumstance (Blum & Spangehl, 1982). Rotter (1966) described locus of control as the extent to which people perceive that events are contingent on their own behavior or, by contrast, attribute such events to chance or fate. Those who interpret such events as being controlled by powerful others, or by complex and unpredictable forces are said to have a belief in external control. Those who see such events as contingent on their own behavior or characteristics have a belief in internal control. Although locus of control is thought to be a relatively enduring dispositional characteristic, studies indicate that it is modifiable through experience (Nowicki & Barnes, 1973; Omizo, Cubberly &, Omizo, 1985; Wege and Moeller, 1985). As stated above, Wege and Moller (1995) suggest that problem solving skills training in particular is one way to increase internal control orientation.

Implicit in this prediction is recognition that in order to acquire cognitive skills through training, we must first receive repeated opportunities to learn, use, and rehearse the skill. Thus, in developing these skills, the problem solver experiences success with them. The path from cognitive skills to locus of control is based on recognition of this combined with reasoning implicit in Rotter's work on locus of control. According to Rotter (1966), if individuals perceive that success is determined by their own skill, not luck or chance, they are more likely to expect future success and to generalize expectancies of success from one task to another similar task. Repeated task success facilitates the expression of internal attitudes, whereas failure fosters

externality. In this case, the repeated experience of successful use promoted during the acquisition of problem solving cognitive skills is expected to produce perceptions that outcomes result from skill, since luck or chance does not happen repeatedly. The repetition of objective task success during training and associated attributions of internal control should facilitate the expression of internal attitudes and the development of internal locus of control. The path in the model from problem solving cognitive skills to locus of control in the present model represents this expected modification for locus of control.

As the model suggests, problem solving cognitive skills' influence on control orientation is expected to produce a subsequent increase in at-risk students' ability to resolve personal and/or academic problems. In other words, elevated internal locus of control will enhance behavioral outcome efficacy, a notion consistent with outcomes from several studies (Schur, 1999, Coleman, et al., 1966, Nowicki & Strickland, 1973, DeMello & Imms, 1999, Haines, McGrath,& Pirot, 1980). The expectation that those high on internal locus of control will initiate, and maintain, problem solving behavior is based on their inherent belief that they can control their own destiny. Believing they have this control, they should see their own efforts to govern outcomes as functional, and they are thus expected to make more attempts to control their environments and/or their behaviors in important life situations (Seeman, 1963; Gore & Rotter, 1963; Strickland, 1965; Phares, 1965). As such, they are more likely to be alert to those aspects of the environment that provide useful information for their future behavior (Rotter, 1966). The deployment of problem solving tools is one example of this.

Self-efficacy. The model suggests also that problem solving cognitive skills can influence behavior outcome efficacy through self-efficacy. Bandura (1977) defines self-efficacy as a learned behavioral trait associated with the perceived ability to carry out desired action, and shows that self-efficacy can be an important factor in determining whether adaptive behaviors will be

initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles or aversive experience (Bandura, 1982). He argues that both the level and strength of self-efficacy can be modified through modeling, observation, and reinforcement. In particular, the form of problem-based learning acquired by students in problem solving skills training has been identified by Bandura (1977) as an effective method for raising levels of self-efficacy. As such, we have reason to expect the path from skills training to self-efficacy

One outcome expected from this increased self-efficacy is an increase in at-risk students' ability to resolve personal and/or academic problems. In other words, increased self-efficacy will enhance behavioral outcome efficacy. This is consistent with evidence showing that self-efficacy can not only help initiate coping behaviors, but can increase and sustain effort to employ these behaviors in the face of obstacles (Bandura, 1982, Bandura & Schunk, 1981). Deeply entrenched barriers to problem solving may appear even more daunting for those with a low sense of self-efficacy. In such cases, individuals are more likely to give up quicker, expend less energy, or fail to initiate problem-solving activities. By contrast, instead of being paralyzed by self doubt and thoughts of inability, students with high self-efficacy may persevere in the face of early failure and achieve greater behavioral efficacy.

Educational risk level. A stated above, the model predicts that educational risk will diminish not only self-efficacy and problem solving cognitive skills, but subsequent behavioral outcome efficacy as well. To begin with, the negative path from risk-level to problem-solving skills is based on the belief that whereas non-risk children may both learn problem-solving skills in the general course of their lives and consciously or unconsciously apply these skills, at-risk children must overcome the barrier of never having acquired these cognitive skills. This view is consistent with the body of research arguing that the problem solving attempts of at-risk students lack sufficient logical development, thoroughness and effort (Blum & Spangehl, 1982) , and that

subsequent problem solving attempts are impulsive and unsystematic (McCluskey, Place et al., 1998).

Finally, the negative path from risk level to self-efficacy signifies that increased risk is associated with a reduction in one's perceived ability to carry out actions. Cubeta, Travers and Sheckley (1999) demonstrate empirically that at-risk students often experience low levels of self-efficacy, something that may be intensified by the history of failure they often experience. Consequently, even when at-risk students acquire problem-solving skills, they feel unable to competently employ them.

<div align="center">Methods</div>

Overview

A quasi experiment used a fully crossed factorial design that varied problem solving skills training (trained, not trained) and the educational-risk level of students (at-risk, non-risk) to determine their influence on measures of behavioral-outcome efficacy. The treatment had students in existing classes participate in a 50 minute problem solving classroom training session, once a week, for seven consecutive weeks (exclusive of testing). One week prior to the problem solving skills training induction, a pre-induction survey measured problem-solving cognitive skill, self-efficacy and locus of control. These measures were used only to determine if expected differences existed between at-risk and non-risk samples. Two weeks after the induction participants completed questionnaires measuring problem-solving cognitive skill, self-efficacy, locus of control, and behavioral outcome efficacy. These were used to test the model.

Research Participants

Participants were between the ages 11-16 years. Initially, 105 students were registered to participate, but 17 students failed to complete the study and were excluded from analyses. All participants came from four schools, two composed of at-risk students (classified by their

institutions as having a statistically high probability of encountering failure, attrition or inadequacies with regard to their formal academic education) and two composed of non-risk students (classified as having a statistically normal probability in these regards). Of 69 students assigned to the treatment group, 30 (later reduced to 24) from one school comprised the at-risk group and 39 (later reduced to 28) from a second school comprised the non-risk group. Of 36 students assigned to the control group, 22 from a third school comprised the at-risk group and 14 from the fourth school comprised the non-risk group. Participation was mandatory in the treatment schools and voluntary in the control schools.

Both schools for at-risk students were mental health centers providing a day-treatment program for at-risk youth who have failed to thrive in traditional academic settings. The focus of the treatment services is the ultimate re-integration of the students into their community schools. The individuals who attend this school exhibit a wide range of learning disabilities, emotional, behavioral, psychological, family, community, and social problems. Each child in the schools exchanges one academic for one therapeutic course per semester. Milieu therapy, where treatment is built into the entire program experienced by students in the school, is practiced.

Problem Solving Skills Training

Five generic tools were used to create the skills training intervention in this study. These included: (1) problem identification, (2) brainstorming, (3) highlighting, (4) advantages, limitations, unique opportunities, and overcoming limitations (ALUO); and (5) planning for action. Each class was built on the material taught in previous classes. Problems were carried over from one class to the next. The instructor provided some problems; other problems were self-generated by students for themselves. The information from earlier classes was continually reviewed and incorporated into subsequent classes. Each of the five skills-training methods was derived from the lesson plans published in Big Tools for Little Thinkers by Keller-Mathers and

Puccio (2000), and Avarello's (1993) exploratory study. For a detailed description of the lesson plans see Morton (2005).

Measures

Four self-report questionnaires were used to obtain measures of problem-solving cognitive skill, self-efficacy, locus of control, and behavioral outcome efficacy. These measures were used in analyses testing the hypothesized path model. All scales and measures are available from the author.

Problem solving cognitive skill. The problem solving cognitive skill measure was composed of three scales designed to measure problem solving fluency (the ability to produce large numbers of ideas), problem solving flexibility (the ability to produce and/or use a variety of kinds of ideas), and problem solving originality (the ability to produce novel or unique ideas). All three were measured by the Unusual Uses Activity (Form A, Cardboard Boxes and Form B, Tin Cans) from the Torrance (1966) Test of Creative Thinking (TTCT). Previous tests of reliability for all three TTCT scales showed support for internal consistency (Yamamoto, 1962) and for test-retest reliability (Mackler, 1962). A composite variable called Problem Solving Cognitive Skills was created by summing the fluency, flexibility, and originality scores of the TTCT. The alpha reliability of this variable was .89.

Fluency was determined by counting the total number of different unusual uses produced for a set of tin cans and cardboard boxes provided in the activity. Each relevant use was awarded one point. Originality was determined through the novelty, or uniqueness of the unusual uses for tin cans and cardboard boxes. The TTCT codebook indicated 26 and 29 respective a priori "zero-originality" coding categories for the tin cans and cardboard boxes. Respondents received no points for a response specifically highlighted on the "zero-originality" list. All other responses were awarded one point each. Flexibility was determined through the breadth of different unusual

uses produced for the tin cans and cardboard boxes. The codebook indicated twenty-eight a priori coding categories, wherein each coding category had a title and specific examples of the kind of unusual uses that are subsumed within it. One point was given for each category used. No credit was given if a category was repeated.

Two individuals who were familiar with the coding manuals coded each flexibility, fluency and originality questionnaires. If a subject's response was not present a priori in the coding categories the researcher made note of it, and when all the questionnaires were completed s/he consulted with the second coder prior to making selections. Each coder determined her coding category for the disputed item independently, and answers were compared. When discrepancies arose, a final coding category was not selected until both coders agreed upon placement. Five items had discrepancies that required discussion. Higher scores indicated greater levels of fluency, flexability and originality.

Self-efficacy. Self-efficacy was measured with the Bosscher and Smit (1998) General Self-Efficacy Scale (GSES-12). The scale includes 12 items using a 5-point Likert-type format to measure three features of self-efficacy (initiative, effort and persistence). Bosscher and Smit combine the 12 items to produce an internal consistency estimate of alpha = .69, and report test-retest scores stable over a two-week period. In the present study, the 12 items were reduced to a 7-item scale. Included were the first three initiative items and the first four perseverance items. Alpha reliability = .77. The remaining 5 items were dropped due to measurement problems.

Locus of control. Locus of control was measured using the Nowicki-Strickland (1973) Scale for Locus of Control for Children, abbreviated version B. The 21-item scale uses a yes/no format. Nowicki-Strickland reported moderate internal consistency estimates of alpha between.63 with younger children to .81 with high-school seniors. Similar increasing test-retest

reliability estimates ranged from .63 to .71. In the present study alpha = .76 after dropping three items (4, 13, and 20).

Behavioral outcome efficacy. Treatment subjects completed 15 Likert-type items designed specifically for this study to measure the behavioral outcome efficacy of tool usage (idea generation, idea evaluation, planning for action, and efficacy of tool usage). Students responded to statements such as "I find that I am more likely to think of different approaches for solving a problem than before this course," and "I find myself better able to cope with problems than before this course." The first 11 items from this scale were summed to form a behavioral outcome efficacy measure with alpha = .95. Items 12-15 were dropped due to measurement problems.

Results

Descriptive statistics for all variables in the model and the correlations among these variables are shown in Tables 1 and Table 2. Data associated with both tables were inspected both for abnormalities. All variables appeared to have means, standard deviations and bivariate relationships that fall in the expected ranges and directions.

INSERT TABLES 1 & 2 ABOUT HERE

Independent samples *t*-tests were then run to examine at-risk and non-risk students for expected differences on pre-induction measures of locus of control, self-efficacy and problem-solving cognitive skills. Results show that at-risk students score significantly lower on pre-test measures of self-efficacy ($M = 3.47$, $SD = .71$) and locus of control ($M = 1.57$, $SD = .18$) than do non-risk students ($M = 3.85$, $SD = .67$, and $M = 1.68$, $SD = .17$ respectively). These differences were significant in the expected direction, $t(88) = 2.60$, $p < .05$, and $t(88) = 2.82$, $p < .05$ respectively. There was no difference on pre-test measures in problem solving cognitive skills, $t(88) = -0.59$, $p = .56$.

Test of the Hypothesized Model

Path analysis was performed on the hypothesized model using the least-squares method. This involves estimating the sizes of the model parameters and testing the overall model fit. Parameter size was estimated by regressing each endogenous variable onto its causal antecedent, and model fit was tested by comparing estimated parameter sizes to the reproduced correlations (see Hunter & Gerbing, 1982). A model considered consistent with the data is one which (1) has substantial paths indicated by coefficients significant at $p < .05$, (2) has differences between parameter estimates and reproduced correlations (errors) that are no greater than what would be expected through sampling error, and (3) passes the test of overall model fit, indicated by a non-significant chi-square goodness of fit result. As the objective of this research was to examine the influence of problem solving skills training and educational risk on behavior outcome efficacy, all models were first inspected for evidence of substantial continuous paths from the former to the latter. If this type of continuous path was absent, the model was considered unable to demonstrate support for the logic underlying this study. The PATH program (Hunter & Gerbing, 1982) was used to determine if these criteria were met. It should be noted that the correlations reported in the tables below were corrected for attenuation due to measurement error during procedures used for model testing. The correlations used to test the hypothesized model are shown in Table 1.

Initial tests failed to support the original model. First, although most paths appeared to be in the predicted direction, not all were large in magnitude. As such, we did not observe the type of substantial continuous paths from problem solving and educational risk to behavior outcome efficacy necessary to support the logic underlying this study. Second, examining predicted and obtained correlations for the unconstrained bivariate relationships shows error for the association between self-efficacy and locus of control (difference = .71, $z = 3.60$, $p = .01$) was substantial, while the error between locus of control and risk level (difference = -30, $z = -1.70$, $p = .09$) was

considerably large. Third, and most notable, the chi-square global test of goodness of fit was significant, $\chi^2(6, N = 88) = 18.81$, $p < .01$. The combined results forced a decision to reject this model, and alternative models were considered.

The fact that patterns consistent with the model's logic were observed combined with inspection of the error terms suggested that a better fitting model could be produced by changes that would remain consistent with the study's original underlying logic. While recognizing that using path analysis to test non-hypothesized models has considerable limitations, the fact that suggested changes were consistent with the original logic prompted the decision to conduct post-hoc analyses on a revised model. Holbert and Stephenson (2002) argue that analysis on respecified models usually produce difficult to replicate findings. As such, any interpretation based on this type of post-hoc analysis should be viewed with skepticism and the results used only to guide future research. The results of post-hoc analyses conducted here are reported with these caveats in mind.

Post-Hoc Analyses

Revisions in the post-hoc model were undertaken with two problems in mind: (1) the weak paths observed for some links in the model, and (2) the substantial residual errors found for the predicted and obtained correlations between locus of control and self-efficacy, and between risk level and locus of control. Concern over the small path coefficients were addressed simply by removing weak paths from the model. Specifically, the paths from problem solving cognitive skill training to self-efficacy, from problem solving cognitive skill to both locus of control and behavioral outcome efficacy, and from locus of control to behavioral outcome efficacy were deemed to small to be acceptable. These were dropped from the revised model. Concerns related to the substantial residual errors suggested that the some variables were not accurately represented in the model. This problem was addressed in the revised model in two different ways.

First, the residual error between self-efficacy and locus of control suggested a relationship between the two variables that was missing from the model. This was addressed by positing the addition of a positive relationship between the two variables, with the expectation being that more internal locus of control would lead to greater self-efficacy. This change simply alters the original model so that instead of positing that locus of control has a direct influence on behavioral outcome efficacy, the model posits that locus of control has an indirect effect on outcomes through its influence on self efficacy. Second, the issue of residual error between risk level and locus of control was addressed by designating educational risk level as a moderating variable. This approach was taken because of the theoretical importance of educational risk level in this study. In essence, designating educational risk level as a moderating variable provided an opportunity to compare how well the model applies to these two different groups. The inclusion of educational risk level as a moderator was accomplished simply by testing the same model separately for non-risk and at-risk kids. At the same time, a path was added from problem solving skills training to locus of control. This path was added to account for the increase in locus of control among at-risk kids expected to result from skills training.

These changes resulted in the simplified model presented in figure 2. The plan called for testing the model separately on the samples of at-risk and non-risk students. At the same time, we realized that testing the model separately on the two sub-samples would result in a very small sample size. With this in mind, the strength of the revised model for all students was first inspected by testing the model with the entire sample of students. Figure 2 shows the path coefficients associated with this test. The correlations used to test the model are the same as those reported in Table 1.

INSERT FIGURE 2 ABOUT HERE

The results of tests on this model were greatly improved. The chi-square test of overall fit was non-significant, χ^2 (6, N = 88) = 2.35, p = .885, and no significant residual errors were observed between predicted and obtained correlations. Moreover, all but one path coefficient were significant, with the final path nearing significance at $p < .10$. Problem solving skills training had a significant positive effect on problem solving cognitive skills, path coefficient = .26, P (.04 $< p < .48$) = .95. Locus of control had a significant positive effect on self-efficacy, path coefficient = .72, P (.52 $< p < .92$) = .95. Self-efficacy had a significant positive effect on behavioral outcome efficacy, path coefficient = .32, P (.02 ρ .62) = .95. Finally, the path from problem solving skills training to locus of control approached significance, path coefficients = .23, P (-.01 $< p < .47$) = .95. Notably, our observation that the path leading to locus of control did not reach significance is no surprise given the fact that education risk was expected to moderate the influence of problem solving skills training on locus of control. After seeing support for the rest of the revised model, separate analyses were conducted on at-risk and non-risk samples to inspect this moderation. Tables 3 and 4 show the correlations used to test these models. The results of these analyses are shown in Figures 3 and 4.

INSERT TABLES 3 & 4 ABOUT HERE

Inspection of the two models is informative. Although tests on the two sub-samples did not show that all path coefficients were substantial at $p < .05$, we find that neither model had errors greater than what would be expected through sampling, and that both models passed the test of overall model fit determined by the observation of a non-significant chi-square. The chi-square was highly non-significant for both at-risk kids, χ^2 (6, N = 46) = 1.32, p = .970, as well as square for non-risk kids, χ^2(6, N = 42) = 2.13, p = .907. Given the small N that results from

splitting the sample, it is no surprise that not all path coefficients would be significant at $p < .05$, yet despite the weak power behind these tests, all paths either reached or approached significance.

Specifically, for at-risk kids, significant positive coefficients were found for the paths from problem solving cognitive skills training to locus of control, .56, $P (.28 < p < .84) = .95$, and from locus of control to self-efficacy, .65, $P (.35 < p < .95) = .95$), whereas the coefficients approached significance for the positive paths from problem solving cognitive skills training to problem solving cognitive skill, .24, $P (-.08 < p < .56) = .95$, and from self-efficacy to behavioral outcome efficacy was .30, $P (-.04 < p < .64) = .95$.

INSERT FIGURE 3 ABOUT HERE

The patterns observed for non-risk students were mostly similar to those of at-risk kids with the exception of the critical path from problem solving skills training to locus of control. For non-risk kids, significant positive coefficients were found for the paths from locus of control to self-efficacy, .73, $P (.45 < p < 1.00) = .95$, and from self-efficacy to behavioral outcome efficacy, .36, $P (.02 < p < .70) = .95$; whereas the coefficient approached significance for the positive path from problem solving skills training to problem solving cognitive skill, .28, $P (-.02 < p < .58) = .95$. Notably, although the coefficient also approached significance for the path from problem solving skills training to locus of control, in this case the negative coefficient observed was in stark contrast to the positive path found for at-risk kids, -.23, $P (-.57 < p < .11) = .95$. The importance of this difference is discussed below.

INSERT FIGURE 4 ABOUT HERE

As such, though not all criteria established for testing model fit were met, the observed outcomes provide evidence consistent with the model. Additional evidence for the predictive utility of the model can be seen in multiple correlation analysis showing that behavioral outcome efficacy is positively associated with the combination of problem solving cognitive skills, locus

of control, and self-efficacy for both at-risk and non-risk kids. In the case of at-risk kids, all of

the exogenous variables combine to account for over 10% of the variance in behavioral outcome

efficacy, R^2 (88) =.102, p< .05. In the case of non-risk kids, these variables account for over

20% of the variance in behavioral outcome efficacy, R^2 (88) =.202, p< .05.

Discussion

The current study sought to examine processes relating problem-solving skills to the

performance of adolescent at-risk students. This study began with a model based on the belief that

both educational-risk level and problem solving skills training would influence behavioral efficacy.

This influence was expected to occur both somewhat directly through their influence on self-

efficacy and more indirectly through their influence on problem solving cognitive skills and

cognitive skill's subsequent influence on locus of control. In the end, the results suggest that

problem solving skills training does influence behavioral efficacy, but that this influence is a bit

different for at-risk and non-risk students. Although the findings clearly indicate that the combined

influence on behavioral outcome efficacy resulting from problem solving skills training, problem

solving cognitive skills, self-efficacy, and locus of control is significant for both non-risk and at-

risk students, some aspects of this influence seem to differ for the two populations.

The Influence of Problem Solving Skills Training on At-Risk Students

The most notable findings in this research are those concerning at-risk students. Three

issues stand out here. First, the results clearly suggest that the type of problem solving skills

training provided in this study can increase locus of control. Second, this increased locus of

control leads to subsequent increased self-efficacy. Third, and most importantly, there is some

indication that this heightened self-efficacy may actually produce an increase in behavioral

outcome efficacy for at-risk students. And while the evidence related to this is tentative at best, its

potential is of great consequence.

With regard to the first issue, this study provides additional evidence for claims that skills-training can alter feelings of locus of control and reduce barriers to problem solving often faced by educationally at-risk students. Skills training appears capable of minimizing belies that life is subject to fate, luck, or the actions of another individual, and instilling the belief that a given act will lead to a desired outcome. Past research on at-risk high school (Omizo, Cubberly & Omizo, 1985; Nowicki & Barnes, 1973) and undergraduate college students (Wege & Moeller, 1985) has demonstrated the problem solving skills training can produce this outcome. The present investigation extends the findings to a younger population of at-risk students for whom the results may be particularly relevant.

When the at-risk students were provided with the problem solving skills training, they were essentially given a roadmap by which they could solve problems through the application of a systematic process. This researcher suggests that the step-by-step process of problem solving skills training may have increased their locus of control through two different (but potentially interacting) mechanisms: problem definition and milieu therapy.

The first step of the problem-solving-skills training required students to define their problems. When students begin to redefine problems into ones which they can solve because they have problem ownership and ones which they cannot solve because they have no problem ownership, the world may begin to seem like a more controllable environment. Students will hopefully begin to perceive the world more in terms that promote internal locus of control. Alternatively, the milieu therapy the students engaged in may have made them more open to alternative therapies and any benefits associated therein. Consequently, the at-risk students may have attended more closely to the problem solving skills training than the non-risk students. Further, since some of their existing therapy was non-graded, these students were more used to a non-graded course, and teachers of these courses might command more respect.

With regard to the second issue, a strong positive path from locus of control to increased self-efficacy indicates that it is possible to improve the levels of self-efficacy among at-risk students. The heightened levels of self-efficacy may reduce risk factors among at-risk students by increasing the student's perceived confidence levels in her/his ability to perform a given action.

In order for increased self-efficacy to occur, a clear demonstration must be made to explicitly highlight the student's ability to perform the desired action. Mastery experiences, where students either successfully execute a desired activity themselves, or watch a similar/esteemed other succeed in the activity through perseverance (Bandura, 1986), have been demonstrated as the most effective ways to create a strong sense of self-efficacy (Bandura, 1982; Pajares, 1997). In the present study, the training program was designed to create situations that lead to repeated student-initiated problem solving success. Each activity was designed to create situations where students successfully mastered the exercise. Further, because there were systematic steps associated with the problem solving, students no longer had to feel that either their efforts or their successes would be random. They had explicit routines they could engage in to successfully solve – or master -problems. All of the above may have help at-risk students to increase confidence in their ability to perform a given action and led to increased self efficacy.

With regard to the last issue, there is some indication that heightened self-efficacy may actually heighten behavioral outcome efficacy in the at-risk students. Although these indications are based on revised models and must be viewed with skepticism, the potential benefits have huge ramifications. One of the primary causes of their inability to successfully problem solve lies in the fact that at-risk students frequently lack effective problem solving structures (Blum & Spangehl, 1982; McCluskey, Place et al., 1998, p3). Any increases in behavior outcome efficacy resulting from a systematic procedure of problem solving skills training, would go a long way to help reduced risk factors associated with these students.

The Influence of Problem Solving Skills Training on Non-Risk Students

In addition to the implications for at-risk students, the findings in this study are of consequence for non-risk students as well. Once again, three issues stand out. The first finding of note is that although evidence of skills trainings' influence on non-risk students in this study is weak, evidence that the influence here differs from at-risk students is strong. The second and third findings are similar to those with at-risk students. The evidence suggests that locus of control increased self-efficacy, and that subsequent to this, self-efficacy increased behavioral outcome efficacy.

The first issue for non-risk students is that problem solving skills training may have increased risk factors associated with non-risk students, as it produced a slightly negative, though not significant, decrease in locus of control. The training may account for this surprising finding in the following way: Non-risk students are better general problem solvers than are high-risk students (Houtz et. al, 1973). Although these students often achieve the correct answers, the process that they utilize to do so may be quite intuitive. When a formalized problem-solving technique is taught, the non-risk students may become cognizant not only of the multiple steps involved in successful problem solving, but of all the things that could possibly go wrong or be unconsidered, ultimately effecting the end result. Non-risk students may thus begin to second guess their ability to control their world as they become cognizant that any one act will not lead to a given outcome, but rather, that it takes multiple acts working in conjunction with one another to achieve a desired outcome. This is not necessarily a long term change, but may exist only during the height of the problem solving learning curve. Longer term testing should be done to establish this fact. Of course, as indicate above, evidence that problem solving skills training decreases locus of control for non-risk students is weak, with a path of -.23, P (-.57 < ρ < .11) = .95. At the same time, the influence clearly differs for non-risk versus high-risk students, where the path

for high risk students of .56, P (.28 < ρ < .84) = .95, has a confidence interval that does not overlap with the interval for non-risk students.

With regard to the second and third issues, the strong positive path from locus of control to increased self-efficacy and from self-efficacy to behavioral outcome efficacy mirror the findings for at-risk students. Notably, these findings indicate that it is possible to improve the levels of self-efficacy among non-risk students. The rational for how locus of control could influence self-efficacy for non-risk students and the ramifications of this finding are similar to those for at-risk students. Observable success might create a sense of mastery that positively influences self-efficacy and subsequent behavioral outcome efficacy. The finding that self-efficacy increased desired outcome behaviors is consistent with results of research on non-risk students found by Sewell and St. George (2000).

Observations from the Combined Sample

The combined sample of at-risk and non-risk students produced two notable findings. First, finding a significant, positive path from problem solving skills training to problem solving cognitive skills provides initial evidence that the type of problem solving skills training provided in this study can improve problem solving cognitive skills in students. Second, the significant path from self-efficacy to behavior outcome efficacy increases our confidence that self efficacy can help all students resolve the problems they encounter in their lives. Though neither of these paths was significant in the models using only at-risk or non-risk students, we might attribute this to the small samples used in subgroup analyses: 46 in the at-risk and 42 in the non- risk model. Seeing both paths reach significance in the combined model is likely due to the increased statistical power from the 88 combined participants and the associated reduction in Type II error.

Although the evidence available does not show a link between cognitive skills and outcome efficacy, the low power associated with the small samples in this study makes it

premature to dismiss this possibility. As Table 1 shows, the zero-order correlation between problem solving cognitive skills and behavioral outcome efficacy among non-risk students was $r =$ .26. Though we do not interpret this as any evidence of a relationship between these two variables, it would not be surprising to see this change with a larger sample. Logic argues that learning these cognitive skills should reduce educational risk factors associated with problem solving. This is especially important for at-risk students since they typically lack the skills to negotiate and resolve many of the academic and social problems they experience in their lives.

Limitations and Recommendations

Caveats on interpretation of weak paths and respecified models are always well heeded. These caveats are amplified by the small sample in this study and the use of participants from only a few educational settings. Surely this limited diversity in the sample. Evidence of problems related to this issue can be seen in the pre-induction survey conducted to see if at-risk and non-risk students varied as expected. Though expected pre-induction differences on measures of self-efficacy and locus of control were found, the lack of expected differences in problem solving cognitive skills might have limited this study's ability to fully test the induction's influence on at-risk students. Perhaps this is attributable to the milieu therapy practiced at both schools for at-risk students, and might account for some of the failed findings in our study. In both the Merle Levine Academy and the Jerome Diamond Center there is a focus upon student responsibility, whereby the students are cognizant of their problems and are in an active protocol to improve upon known deficiencies. The result of such an endeavor may have worked toward evening the playing field between the at-risk and non-risk students with regard to problem solving.

Future efforts should attempt to replicate the findings in this investigation on a larger sample of participants from more diverse educational settings. Efforts should also be made to use longitudinal designs that study the dynamic change in these processes over time. This will allow

us to compare the influence of this training on those who let lessons germinate for a while with others who use it right away and then cease. Practical experience from this study leads us to advise others who provide future problem solving skills training to make this a graded course in which class participation, homework and an exam or essay constitute the basis for the final mark. A graded course will force students to utilize the problem-solving techniques, thus giving them a chance to internalize the skills through practice on their individual real life problems. Finally, we advise future scholars to select students from schools that do not practice milieux therapy. This will allow us to see how at-risk students in a traditional academic setting respond to treatment.

In spite of the limitations endemic in any field experiment such as this one, the present investigation offers valuable insight concerning processes that may benefit at-risk students. It suggests that the type of problem solving skills training provided in this study might heighten the internal locus of control in at-risk students, increase associated self-efficacy, and subsequently improve the behavioral outcome efficacy of this special group. The great consequence of this possibility makes it difficult simply dismiss these findings. Although, by itself, our study does not provide the type of conclusive evidence needed to make decisions on the implementation of these training programs, the evidence here substantiate the need for closer consideration.

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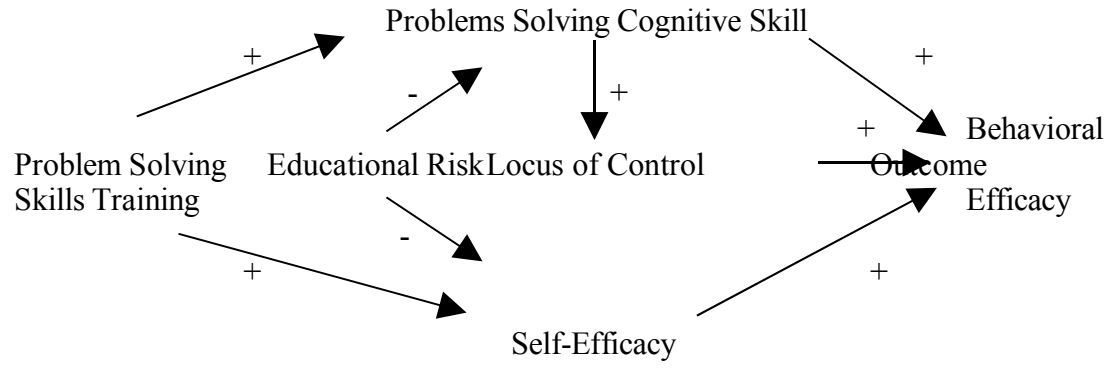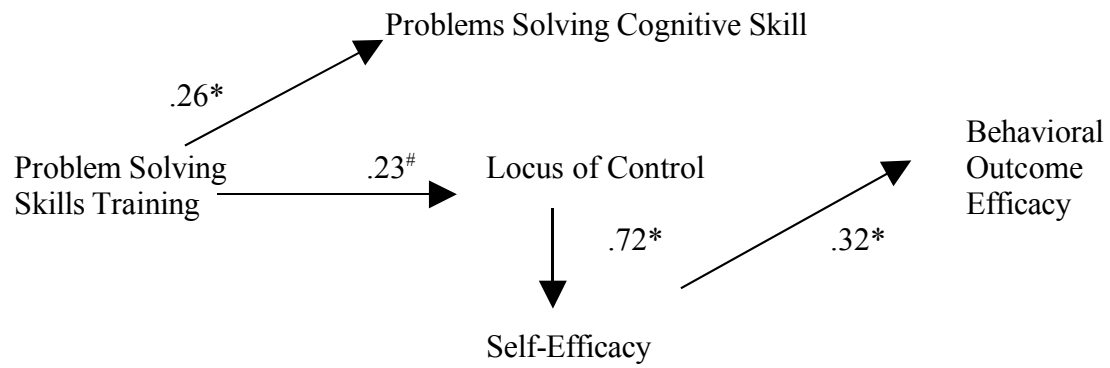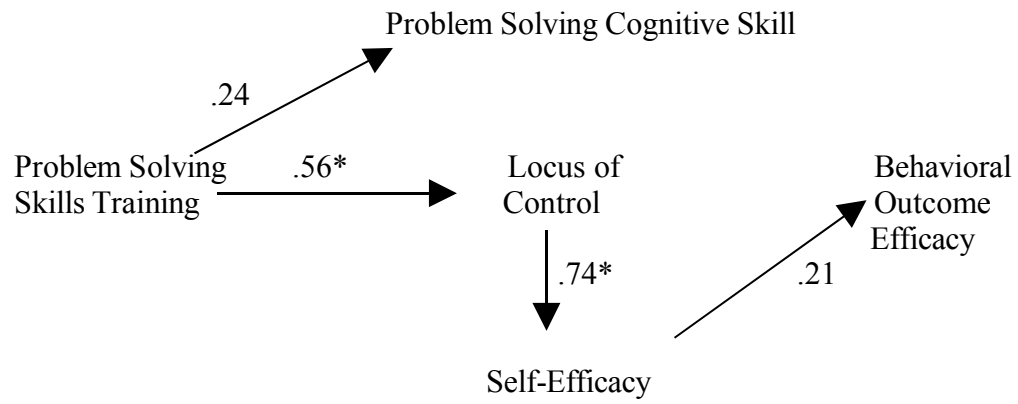*Figure 1*. Path Model of Hypothesized Relationships

Figure2: Revised Model Using Combined Sample, Corrected for Attenuation

Problems Solving Cognitive Skill

.26*

Problem Solving
Skills Training

.23#

Locus of Control
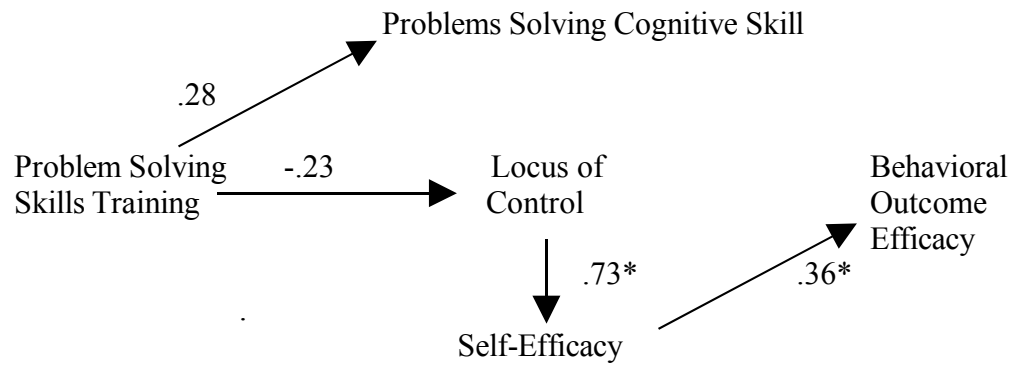
Behavioral
Outcome
Efficacy

.72*

.32*

Self-Efficacy

* Significant at $p < .05$, two-tailed
# Significant at $p < .10$, two-tailed

Figure 3. Second Revised Model Using Only At-Risk Students, Corrected for Attenuation

Problem Solving Cognitive Skill

.24

Problem Solving
Skills Training

.56*

Locus of
Control

Behavioral
Outcome
Efficacy

.74*

.21

Self-Efficacy

* Significant at *p* < .05, two-tailed.

Figure 4. Second Revised Model Using Only Non-Risk Students, Corrected for Attenuation

* Significant at *p* < .05, two-tailed

Table 1

Descriptive Statistics for Key Variables in Path Model

Risk Level		Problem Solving Cognitive Skill	Self-Efficacy	Locus of Control	Behavioral Outcome Efficacy
Non-Risk	N Valid	42	42	42	28
	Mean	16.12	3.86	1.69	3.32
	Std. Deviation	7.24	.78	.21	.80
	Minimum	.00	2.0	1.0	1.0
	Maximum	30.33	5	2	4.45
At-Risk	N Valid	46	46	43	24
	Mean	15.80	3.59	1.60	2.96
	Std. Deviation	6.70	.70	.20	1.18
	Minimum	3.33	1.86	1.17	1.00
	Maximum	38.0	5	1.94	5.0

Table 2

Zero-Order Correlations Used to Calculate Parameter Estimates in Model

	1	2	3	4	5	6
1. Problem Solving Skills Training	*1.00*					
2. Risk Level	-.15	*1.00*				
3. Problem Solving Cognitive Skills	.25*	-.02	*.89*			
4. Self-Efficacy	.08	-.18	.17	*.77*		
5. Locus of Control	.20	-.26*	.11	.55*	*.76*	
6. Behavioral Outcome Efficacy	#	-.18	.17	.27	.22	*.95*

Note. Skills training was coded such that 1 = received skills training and 0 = did not receive skills training. Risk level was coded such that 1 = at-risk and 0 = non-risk. Standardized item alpha appears in the diagonal.

*indicated $p < .05$, two tailed.

Cannot be computed since Outcome Efficacy at not measured for skills training = 0.

Table 3

Zero-Order Correlations on At-Risk Students Used for Estimates in Figure ?

	1	2	3	4	5
1. Problem solving skills training	*1.00*				
2. Problem solving cognitive skills	.24	*.89*			
3. Self efficacy	.26	.22	*.77*		
4. Locus of control	.49*	.23	.50*	*.76*	
5. Behavioral outcome efficacy	#	.10	.26	.23	*.95*

Note. Skills training was coded such that 1 = received skills training and 0 = did not receive skills training. Standardized item alpha appears in the diagonal.

* indicates $p < .05$, two-tailed.

Cannot be computed since Outcome Efficacy at not measured for skills training = 0.

Table 4

Zero-Order Correlations on Non-Risk Students Used for Estimates in Figure ?

	1	2	3	4	5
1. Problem solving skills training	*1.00*				
2. Problem solving cognitive skills	.26	*.89*			
3. Self efficacy	-.20	.11	*.77*		
4. Locus of control	-.15	-.02	.57*	*.76*	
5. Behavioral outcome efficacy	#	.26	.31	.26	*.95*

Note. Skills training was coded such that 1 = received skills training and 0 = did not receive skills training. Standardized item alpha appears in the diagonal.

* indicates *p* < .05, two-tailed.

Cannot be computed since Outcome Efficacy at not measured for skills training = 0.