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The Effect of Problem-Solving Skills Training Based on Personal Competencies on Self-Efficacy Beliefs and Epistemological Beliefs in Adolescents

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ABSTRACT

Self-efficacy beliefs and epistemological beliefs are considered fundamental factors in students' academic and cognitive development. The aim of the present study was to examine the effectiveness of problem-solving skills training on adolescents' self-efficacy beliefs and epistemological beliefs. This study employed a quasi-experimental method using a pretest-posttest design with a control group. The sample consisted of secondary school students who were randomly assigned to experimental and control groups. The experimental group received six 90-minute sessions of problem-solving skills training, while the control group continued their regular educational activities. Data collection tools included the General Self-Efficacy Scale developed by Sherer et al. (1982) and the Epistemological Beliefs Questionnaire by Newmann and Conrad (2000). Data were analyzed using analysis of covariance (ANCOVA). The results indicated that problem-solving skills training had a significant effect on increasing students' self-efficacy beliefs and enhancing their epistemological beliefs ($p < .05$). The posttest mean scores of the experimental group in both variables were significantly higher than those of the control group. Problem-solving skills training can be utilized as an effective strategy for improving self-efficacy beliefs and strengthening epistemological beliefs in students. Empowering students through problem-solving skills training leads to cognitive growth, increased responsibility, and more informed decision-making.

Keywords: Problem-solving skills training, self-efficacy, epistemological beliefs, adolescents.

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Introduction

Education is one of the most important foundations and social institutions, emerging from within society while simultaneously serving as a constructive and evolutionary force in shaping and advancing that society. Among the most essential goals of education—ones that researchers have continually emphasized—is the cultivation of motivated, goal-oriented, achievement-driven, and competent learners. In this regard,

educational science, particularly in the areas of motivation and learning, plays a crucial role in steering these goals using updated research findings and has consistently yielded significant achievements in understanding human nature and enhancing individuals' capabilities (1).

Schools are considered key institutions in the comprehensive development of a nation. By facilitating the production and deepening of knowledge, they enable the continuity of learning and the active participation of students in various social, economic, and cultural domains. One of the goals of education is to train students who can engage in problem-solving using diverse strategies—a goal that holds a prominent position in educational theory and practice (2).

Students' problem-solving abilities and mental flexibility depend on several factors. One of the key concepts associated with academic success is self-efficacy (3). Self-efficacy refers to "an individual's judgment of their ability to successfully perform a specific task or activity (4, 5)." Self-efficacy beliefs determine the amount of effort individuals invest in their activities and the extent of their persistence in the face of obstacles (6). Self-efficacy has a profound impact on behavior. For instance, a person with low self-efficacy may fail to prepare for challenges, believing that no amount of effort would lead to success. In contrast, individuals with high self-efficacy tend to be more hopeful and effective in performing tasks. Consequently, learning is limited by low self-efficacy and enhanced by high self-efficacy (7).

Another variable examined in the current study is the epistemological system of individuals. Michel Foucault introduced the concept of "episteme" or "system of knowledge," referring to the structure that governs thought in any given era. In other words, the epistemological system is the set of relations that organize discursive practices within a specific period (8). It can also be understood as a network of dominant relationships in a given era from which knowledge emerges. The three primary dimensions of the epistemological system are "knowledge creation," "knowledge sharing," and "knowledge application" (9).

In recent years, the field of education has undergone significant transformations—transformations necessary for training students capable of shaping their future in an evolving world and playing an active role in addressing large-scale global issues. Consequently, skills such as problem-solving, coexistence, and familiarity with new technologies have gained prominence in education (10). In the face of modern challenges, stereotypical thinking and traditional methods are no longer sufficient. Among the essential life skills for today's world is problem-solving. Problem-solving is a cognitive process used to identify appropriate solutions for achieving specific goals. Life, in essence, is an ongoing engagement with problems and efforts to understand and resolve them. Problems typically arise in uncertain and conflicting situations and represent the gap between the current and desired states. Various studies have confirmed the positive effects of problem-solving training on reducing interpersonal sensitivity, aggression, high-risk behaviors, and stress, while improving social relationships (11).

Considering the points mentioned above, issues such as students' self-efficacy beliefs and epistemological systems—which are fundamental to the future of any society—remain among the most critical educational concerns. Therefore, educational systems must adopt methods and programs that enhance students' positive attributes. Nonetheless, a review of existing research reveals a noticeable gap in the application of psychological interventions within educational institutions, including both schools and universities. Thus, the present study aims to answer the following question: Does problem-solving skills training based on personal competencies influence students' self-efficacy beliefs and epistemological systems?

Methods and Materials

Study Design and Participants

The present study was a quasi-experimental design with a pretest-posttest structure and a control group. The statistical population included all second-level high school students in Tehran during the 2023–2024 academic year. From the target population, 30 eligible students who volunteered to participate in the study were selected using purposive sampling (the sample size was determined based on an effect size of 0.25, alpha level of 0.05, and power of 0.80, resulting in 15 participants per group). Participants were randomly assigned to an experimental group (n = 15) and a control group (n = 15). Inclusion criteria were informed consent, age between 15 and 18 years, current enrollment in secondary education, no simultaneous participation in other psychotherapeutic programs, and physical and mental readiness to participate. Exclusion criteria included missing more than two sessions, unwillingness to continue participation, concurrent enrollment in other counseling or therapy programs, and non-cooperation in completing the pretest and posttest questionnaires.

After random assignment, participants in both experimental and control groups were briefed about the research goals and procedures. Both groups then completed informed consent forms and the self-efficacy and epistemological beliefs questionnaires as a pretest. The experimental group received six 90-minute sessions of problem-solving skills training, while the control group continued receiving routine treatment. After the completion of the intervention sessions, a posttest was administered to both groups. To adhere to ethical standards, the control group was also offered three educational sessions over the course of one week after the study concluded.

Data Collection

The General Self-Efficacy Scale, developed by Sherer et al. (1982), was used to assess general self-efficacy beliefs. This scale consists of 17 items that measure behavioral dimensions such as willingness to initiate behavior, willingness to expand effort to complete a task, and persistence in the face of obstacles. The questionnaire uses a Likert scale ranging from “strongly disagree” to “strongly agree.” Each item is scored from 1 to 5. Items 1, 3, 8, 9, 13, and 15 are reverse-scored (right to left), while the remaining items are scored directly (left to right). The maximum score achievable on this scale is 85, and the minimum is 17. Sherer (1982) reported the internal consistency reliability using Cronbach’s alpha as 0.76 (12). The scale was first translated and validated in Iran by Bakhtiari Barati (1997). Reported reliability coefficients for this scale include 0.79 (Bakhtiari Barati, 1997), 0.85 (Abdiania, 1998), and 0.91 (4).

The Epistemological Beliefs Questionnaire by Newmann and Conrad (2000) consists of 21 items and includes four components: knowledge creation, knowledge sharing, knowledge application, and knowledge storage. It is scored using a Likert scale ranging from “strongly disagree” to “strongly agree,” with scores ranging from 1 to 5 for each item. The total possible score ranges from 21 to 105 (8). Construct validity of the Persian version was confirmed using factor analysis based on Nonaka’s knowledge management theory with varimax rotation. Cronbach’s alpha for internal consistency was reported as 0.88, and based on Abbasi’s report, the reliability coefficient using Cronbach’s alpha was also found to be 0.78 (13).

Intervention

All training sessions for the experimental group were based on the six-stage model by D'Zurilla and Goldfried (1971), which includes the following steps: general orientation, problem definition and formulation, generation of alternative solutions, decision-making, solution implementation, and evaluation. Each of the six sessions lasted 90 minutes and was designed and executed accordingly. The intervention protocol was implemented over six structured sessions based on the D'Zurilla and Goldfried (1971) problem-solving model. In the first session, the focus was on general orientation, where participants learned to recognize problems, accept them as naturally changeable phenomena, trust the effectiveness of a structured problem-solving approach, develop high self-efficacy expectations, and practice the habit of pausing, thinking, and then acting. The second session involved defining and formulating the problem by gathering all available information, distinguishing facts from assumptions requiring further investigation, breaking down the problem into components, and clarifying actual goals. In the third session, participants were guided to generate a wide range of alternative solutions, enabling the selection of the most effective response. The fourth session focused on decision-making, where participants anticipated the possible consequences of each option and evaluated their usefulness. The fifth session was dedicated to implementing the chosen solution. Finally, in the sixth session, participants reviewed the outcomes, observed the results of their implementation, and engaged in evaluation to assess effectiveness and inform future action.

Data analysis

Data were analyzed using SPSS version 22 and analysis of covariance (ANCOVA), ensuring that statistical assumptions were met.

Findings and Results

In both groups, the highest frequency was observed among participants aged 17 and 18, and the percentage of 16-year-old individuals was slightly higher in the control group compared to the experimental group. Overall, the age composition of the groups was relatively similar, and the minor differences observed do not pose a significant threat to the homogeneity of the samples; thus, it can be concluded that the groups were approximately matched in terms of age. Table 1 reports the descriptive findings of the study variables.

Table 1. Descriptive Statistics for Self-Efficacy and Epistemological System Variables in the Study Groups

Variable	Group	Statistical Index	Pretest	Posttest
Knowledge Creation	Problem-Solving Skills Training	Mean	15.00	21.47
		Std. Deviation	4.29	3.60
	Control Group	Mean	14.80	14.47
		Std. Deviation	3.90	5.54
Knowledge Sharing	Problem-Solving Skills Training	Mean	15.93	19.47
		Std. Deviation	3.73	2.92
	Control Group	Mean	15.60	14.93
		Std. Deviation	2.97	3.94
Knowledge Application	Problem-Solving Skills Training	Mean	13.27	19.67
		Std. Deviation	2.43	3.27
	Control Group	Mean	12.80	11.27
		Std. Deviation	2.01	3.31
Knowledge Storage	Problem-Solving Skills Training	Mean	16.87	20.87
		Std. Deviation	3.80	2.80

	Control Group	Mean	16.13	15.13
		Std. Deviation	2.92	4.52
Self-Efficacy	Problem-Solving Skills Training	Mean	49.00	67.00
		Std. Deviation	14.24	14.54
	Control Group	Mean	48.53	47.00
		Std. Deviation	13.92	17.24

Table 1 illustrates the descriptive statistics for the variables of self-efficacy and epistemological system at the pretest and posttest stages for both the experimental and control groups. In the control group, the mean scores for self-efficacy and the epistemological system showed only slight changes from pretest to posttest, indicating that in the absence of educational intervention, no significant improvement occurred in these variables. In contrast, the experimental group, which underwent problem-solving skills training, demonstrated a marked increase in the mean scores of both self-efficacy and the epistemological system from pretest to posttest. These patterns indicate that problem-solving skills training had a positive impact on enhancing students' self-efficacy and epistemological beliefs.

Before conducting the analysis of covariance (ANCOVA), the normality assumption was tested using the Shapiro-Wilk test. This assumption posits that the difference between the sample score distribution and the normal distribution in the population is zero. The results of the test showed that all variables in both the pretest and posttest stages followed a normal distribution. Additionally, Levene's test was used to assess the homogeneity of variances. The results confirmed that the homogeneity assumption held for all study variables ($p > .05$). Accordingly, the results of the ANCOVA comparing the two groups on self-efficacy and epistemological system variables across the pretest-posttest stages are presented in Table 2.

Table 2. ANCOVA Results for Comparing Groups on Self-Efficacy and Epistemological System Variables at Pretest and Posttest

Variables	Source of Variation	SS	df	MS	F	Significance Level	Eta Squared
Knowledge Creation	Group	351.26	1	351.26	19.13	0.001	0.45
	Error	422.42	23	18.37			
Knowledge Sharing	Group	137.50	1	137.50	20.70	0.001	0.47
	Error	152.75	23	6.64			
Knowledge Application	Group	477.82	1	477.82	49.70	0.001	0.68
	Error	221.15	23	9.62			
Knowledge Storage	Group	197.54	1	197.54	20.59	0.001	0.47
	Error	220.63	23	9.59			
Self-Efficacy	Group	2675.10	1	2675.10	12.95	0.001	0.36
	Error	4752.56	23	206.63			

The results of ANCOVA indicated that there was a statistically significant difference between the groups in self-efficacy and epistemological system variables after the intervention. These findings suggest that the problem-solving skills training effectively improved participants' self-efficacy and epistemological beliefs compared to the control group. Additionally, the results show that the effect of the intervention was strong and meaningful. Although the pretest had some influence on the outcomes, the primary changes are attributed to the educational intervention.

Discussion and Conclusion

Examining self-efficacy beliefs and epistemological systems in students is of great importance; therefore, the present study aimed to determine the effectiveness of problem-solving skills training on adolescents'

self-efficacy and epistemological beliefs. The results showed a statistically significant difference between the experimental and control groups in the variable of self-efficacy beliefs, indicating that group membership had a meaningful impact. Thus, it can be concluded that training in problem-solving skills significantly affected students' self-efficacy beliefs.

These findings align with the prior results (14, 15). In explaining these findings, Bandura (1997) argued that self-efficacy is a generative capability through which individuals organize cognitive, social, emotional, and behavioral skills to achieve diverse goals effectively. He maintained that having knowledge, skills, and previous accomplishments alone does not predict future performance. Rather, individuals' beliefs in their abilities to carry out these tasks play a more decisive role. Indeed, while students at the secondary level may be aware of their responsibilities, they often lack the skills needed to implement their knowledge effectively, highlighting the need for targeted training. To become self-efficacious, students must be able to use their knowledge to initiate behaviors and organize their actions in a way that yields desirable outcomes. Problem-solving training specifically targets these skills and can therefore be beneficial. As such, teaching problem-solving skills by presenting a structured process for applying one's knowledge in real situations can enhance self-efficacy beliefs.

The results also showed that there was a statistically significant difference between the experimental and control groups in the epistemological beliefs variable. These findings are in agreement with the prior results (14, 16, 17). To interpret these findings, it is helpful to consider McElroy's (2006) model, which identifies two key stages influenced by the epistemological system. The first stage, knowledge production, involves the creation of new knowledge through group learning, information acquisition, and knowledge evaluation—processes closely linked to the problem-recognition and analysis components of problem-solving. The second stage, knowledge integration, includes planning, inquiry, group and individual instruction, knowledge sharing, and other social activities that foster communication (17). This stage plays a critical role in problem-solving, as the knowledge and information identified during the first stage must be utilized effectively. Without the integration of knowledge into problem-solving, students' cognitive development may remain incomplete, as raw information lacks contextual value unless connected to existing knowledge frameworks. The problem-solving process provides a structure for this integration, transforming raw data into meaningful knowledge.

The present study faced several limitations. These included the absence of a follow-up period, reliance on self-report questionnaires, and inability to control for potential confounding demographic variables such as economic status or level of social welfare.

It is recommended that schools implement group-based problem-solving skills training sessions for students. In addition, teachers should receive professional development workshops to familiarize them with these methods and techniques to support students' academic performance.

Future research should consider comparing the effectiveness of problem-solving skills training with other educational approaches. Furthermore, to enhance the generalizability of the findings, it is advisable to conduct similar studies among students in other cities and demographic groups.

Based on the findings, it can be concluded that problem-solving skills training based on personal competencies has a significant effect on adolescents' self-efficacy beliefs and epistemological systems. In light of these results, it is recommended that educational workshops be organized for school counselors,

teachers, and even parents to raise awareness of the role and impact of problem-solving skills training on student outcomes.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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