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Comparing the Effectiveness of Problem-Solving Skills Training Based on Tolman's and Bandura's Theories on Adolescent Girls' Problem-Solving Styles

Shokoofeh. Khoshneshan[1], Davood. Taghvaei[2*], Zabih. Pirani[3]

[1] PhD Student, Department of Psychology, Arak Branch, Islamic Azad University, Arak, Iran
[2] Associate Professor, Department of Psychology, Arak Branch, Islamic Azad University, Arak, Iran
[3] Assistant Professor, Department of Psychology, Arak Branch, Islamic Azad University, Arak, Iran

*** Corresponding author email address**: d-taghvaeii@iau-arak.ac.ir

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A B S T R A C T

Objective: The purpose of this study was to compare the effectiveness of problem-solving skills training based on the theories of Tolman and Bandura on the problem-solving styles of middle school students.

Methods: The research method was quasi-experimental. The population consisted of all female first-year middle school students in Hamadan, with a sample size of 75 students (three groups of 25), selected through multi-stage cluster sampling. The D'Zurilla, Nezu, and Maydeu-Olivares problem-solving questionnaire (2000) was used for data collection. Problem-solving training sessions based on Tolman's theory followed a protocol provided by Tolman (1932), and those based on Bandura's theory followed a protocol by Bandura (1999), conducted over eight 60-minute weekly sessions for two months. Data were analyzed using Multivariate Analysis of Covariance (MANCOVA) and the Scheffé post hoc test.

Findings: There were differences in the impact of training based on these theories on students' problem-solving styles ($P < .01$). Training based on Tolman's theory was more effective in reducing the use of negative and impulsive problem-solving styles compared to training based on Bandura's theory ($P < .01$).

Conclusion: These trainings increased the use of positive and logical orientation styles and decreased the use of negative, avoidant, and impulsive styles among students.

Keywords: *Problem-solving style, problem-solving skills, student.*

1. Introduction

Problem-solving skills, a fundamental skill for life in the modern era, can be learned. Lack of proper problem-solving skills is associated with a number of emotional and behavioral problems in adulthood, such as depression and anxiety; this is because problem-solving is defined as complex behavioral and cognitive processes aimed at adapting to internal and external challenges (Parsakia, 2023; Wiltshire et al., 2018). Problem-solving skills refer to a cognitive-behavioral process that provides a variety of alternative and potential responses to challenging situations,

increasing the possibility of choosing the best and most effective responses (Smith, 2021).

Different theories and educational methods can be used to teach problem-solving skills. Therefore, it is essential for educators and teachers to be familiar with various learning and teaching theories as much as possible. Familiarity with learning theories teaches us how to analyze individuals' learning processes, facilitate learning by emphasizing important points that need attention, and by referencing our expectations. Among cognitive theories, one can mention the theories of Tolman and Bandura (Du et al., 2023). Tolman's learning theory, like behaviorists, did not value introspective approaches and believed that psychology should be entirely objective. However, his main disagreement with behaviorists was over the unit of behavior that should be examined. Unlike other behaviorists, Tolman focused on the systematic study of integrated behavior. Methodologically, Tolman was a behaviorist, but metaphysically, he was a cognitive theorist. In other words, he studied behavior to discover cognitive processes (Miglino et al., 2007).

Albert Bandura, a leading twentieth-century Canadian psychologist, is renowned as a pioneering theorist in observational learning. According to Bandura, observational learning may or may not involve imitation. For example, while driving, you might observe that the car in front of you falls into a pothole. Based on this observation, you change your car's path to avoid falling into the hole and prevent damage to your vehicle. In this example, you learned from the observation, but you did not imitate what you saw. According to Bandura, what you learned was information that was cognitively processed and acted upon to your advantage. Thus, observational learning is much more complex than simple imitation, which is typically a replication of another person's actions (Smith, 2021).

Given the importance of problem-solving skills in students and the role of various psychological theories, especially cognitive theories, in aiding skill learning and behavior modification in students, this research is of high importance and is crucial in better explaining the role of prominent theories in the field of learning psychology in teaching problem-solving skills. The goal of this research is to compare the effectiveness of problem-solving skills training based on the theories of Tolman and Bandura on the problem-solving styles of middle school students.

2. Methods

2.1. Study design and Participant

This study is a quasi-experimental research, and the population includes all female first-year middle school students in the city of Hamadan, totaling 6,130 individuals. The sample size was 75 students (three groups of 25), selected through multi-stage cluster sampling. One group received training in problem-solving skills based on Tolman's theory, another based on Bandura's theory, and a third group served as the control, receiving standard education. Before implementing the plan, a pre-test of problem-solving skills was conducted on all three groups. After matching the three groups of 25 students based on their problem-solving skills status, they underwent training in problem-solving skills based on the theories of Tolman and Bandura over eight sessions. After the training, a post-test of problem-solving skills was conducted, and the results were compared.

2.2. Measures

2.2.1. Social Problem-Solving

The short form of the revised Social Problem-Solving Inventory by D'Zurilla, Nezu, and Maydeu-Olivares (2000) was used to measure social problem-solving styles. This questionnaire consists of 25 questions scored on a 5-point Likert scale from 'not at all' (1) to 'very much' (5). Two subscales of this questionnaire measure problem-solving orientation: positive problem-solving orientation (questions 5-7-14) and negative problem-solving orientation (questions 2-4-9-13-22). Three subscales also measure social problem-solving style: logical problem-solving style (questions 3-8-16-20-21-24-25), avoidant problem-solving style (questions 1-10-12-17-18), and impulsive-carelessness problem-solving style (questions 6-11-15-19-23). The positive orientation to the problem and the logical problem-solving style are considered as effective problem-solving subscales, and the negative orientation to the problem, the avoidant problem-solving style, and the impulsive problem-solving style are considered as ineffective problem-solving subscales (D'Zurilla & Nezu, 1990). The construct validity of the questionnaire has been confirmed through exploratory factor analysis and correlation with other problem-solving scales and psychological constructs. The test-retest reliability of the questionnaire has been reported between .68

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and .91, and the Cronbach's alpha coefficient between .69 and .95 (D'Zurilla & Nezu, 1990; Khakpour et al., 2021).

2.3. Intervention

2.3.1. Teaching with Tolman's Theory

The training sessions, based on a protocol provided by Tolman (1932), were conducted over eight 60-minute sessions weekly for two months (Miglino et al., 2007).

Session 1: The first session introduces Edward C. Tolman's theory, emphasizing the integrated view of issues and lessons from another element, the importance of goal-directed behavior, and forming small groups of five students each in the classroom. The session begins with the administration of a pre-test to assess the students' initial problem-solving skills.

Session 2: This session focuses on introducing various problem-solving styles, along with positive and negative attitudes towards problems. It also covers the sub-scales of problem-solving which include logical, avoidant, and impulsive styles. These concepts are fundamental in understanding the cognitive framework that shapes problem-solving approaches.

Session 3: The third session teaches methods of identifying and defining problems, considering the objective aspects of issues. It emphasizes recognizing larger, complete, and meaningful patterns in the genesis of problems, and the importance of linking elements to create a comprehensive understanding of a problem.

Session 4: Students are introduced to hypothesis formulation in problematic situations. This session uses strategies to eliminate incorrect approaches, leaving the correct solutions, and aims to strengthen intrinsic motivation among students for tackling the problems at hand.

Session 5: The fifth session applies Tolman's learning principles and rules to problem-solving. It introduces the principle of "force finding" in identifying solutions specific to a situation and highlights the importance of differences in problem conditions and solutions. The session uses local favorite foods as metaphors for hunger-driven behavior to illustrate these concepts.

Session 6: This session covers the use of field theory concepts in identifying and selecting appropriate problem-solving styles. It details the relationships between different components that contribute to a problem and the expectations of observing signs or consecutive impacts of a solution on various aspects of problems.

Session 7: Students learn about the learning principle of distinguishing cues and motor patterns in response to stimuli. This session teaches how to organize the perceptual field within a specific plan, enhancing the cognitive processing of environmental cues.

Session 8: The final session summarizes the confrontation stages with problems and the selection of solutions, reviewing Tolman's learning principles, including behavioral integration, force finding, equivalent beliefs, field expectations, distinguishing cues, and eliminating incorrect strategies. A post-test is administered to assess the acquired skills and knowledge.

2.3.2. Teaching with Bandura's Theory

The training sessions, based on a protocol provided by Bandura (1999), were conducted over eight 60-minute sessions weekly for two months (Smith, 2021).

Session 1: An introductory session presents Albert Bandura's theory, emphasizing the importance of observational learning and the conditions of the course. It stresses the necessity of cooperation and assignment completion, starting with a pre-test to evaluate initial problem-solving skills.

Session 2: This session introduces different styles of problem-solving and attitudes towards problems, covering positive and negative outlooks, and explaining logical, avoidant, and impulsive problem-solving styles. This builds a foundation for understanding how individuals approach and manage problems.

Session 3: Utilizing video clips and films, this session helps identify the dimensions of a problem and set its boundaries. The pattern recognition method is employed to teach how to identify and define problems effectively.

Session 4: Educational films based on Bandura's observational learning theory are shown to demonstrate how to identify and select appropriate solutions. The importance of continuous and ongoing learning is emphasized.

Session 5: Real or fictional films are presented showing how individuals confront problems and the outcomes they achieve. Attention is drawn to the effective actions of the main character, highlighting exemplary behaviors and using indirect reinforcement of behaviors aligned with the model.

Session 6: A presentation or a narrative, either fictional or real, is used, with pauses for students to predict outcomes and focus on attention, retention, and the ability to reproduce learned behaviors in real situations.

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Session 7: The role of organization in tasks and the explanation of motivational beliefs are introduced. Assignments are tailored to match individuals' capabilities, setting goals that are neither too difficult nor too easy to enhance motivation and capabilities.

Session 8: The final session summarizes the content covered, explaining the role of environment, behavior, and personal factors in Bandura's theory and the reciprocal or deterministic nature of behavior. It teaches methods for gaining experience and practicing intelligent observation in problem-solving, concluding with a post-test.

2.4. Data Analysis

Data analysis took place in two parts: descriptive, including frequency, percentage, mean charts, and standard deviation; and inferential, including the Kolmogorov-Smirnov test to check the normality of data, Multivariate Analysis of Covariance (MANCOVA), and Scheffé's post hoc test for hypothesis testing.

3. Findings and Results

In this study, the statistical sample was enrolled in the eighth grade. Fifty-four percent of the fathers of the sample had education below high school diploma, 23% had high school diplomas, 7% had associate degrees, 5% had bachelor's degrees, and 11% had master's degrees. Fifty-nine percent of the mothers had education below high school diploma, 24% had high school diplomas, 2% had bachelor's degrees, 14% had master's degrees, and 1% had doctoral degrees. Fifty-four percent of the fathers were self-employed, 31% were employees, and 15% were farmers. Eighty percent of the mothers were homemakers, 13% were employees, and 7% were self-employed.

Table 1

Pre-test Conditions of Each Comparison Group

Group	Problem-Solving Style	Number	Mean	Standard Deviation
Bandura	Positive Orientation	25	13.12	1.64
	Negative Orientation	25	15.28	4.47
	Logical Style	25	28.92	2.87
	Avoidant Style	25	10.76	3.12
	Impulsive Style	25	13.02	3.68
Tolman	Positive Orientation	25	12.88	2.02
	Negative Orientation	25	13.76	3.34
	Logical Style	25	28.92	3.29
	Avoidant Style	25	10.08	3.88
	Impulsive Style	25	13.24	3.46
Control	Positive Orientation	25	12	2.17
	Negative Orientation	25	14.52	3.17
	Logical Style	25	29.28	2.22
	Avoidant Style	25	10.92	3.53
	Impulsive Style	25	13.92	3.65

According to Table 1 data, there was no significant difference between the experimental groups and the control group in problem-solving style, positive orientation, negative orientation, logical style, avoidant style, and impulsive style in the pre-test.

Table 2

Post-test Conditions of Each Comparison Group

Group	Problem-Solving Style	Number	Mean	Standard Deviation
Bandura	Positive Orientation	25	14.4	0.81
	Negative Orientation	25	10.08	3.71
	Logical Style	25	32.96	1.96
	Avoidant Style	25	6	2.04
	Impulsive Style	25	9.72	2.73
Tolman	Positive Orientation	25	14.68	0.47
	Negative Orientation	25	7.16	2.17

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	Logical Style	25	33.48	1.5
	Avoidant Style	25	4.92	2.3
	Impulsive Style	25	6.88	2.36
Control	Positive Orientation	25	12.24	1.96
	Negative Orientation	25	14.2	2.95
	Logical Style	25	29.56	2.16
	Avoidant Style	25	10.72	3.39
	Impulsive Style	25	13.64	3.52

According to the data in Table 2, there are differences between the experimental and control groups in the post-test. To ensure the significance of these differences, results from the analysis of covariance are utilized, which is detailed further below. The covariance analysis examined the effects of Tolman's and Bandura's theories on the problem-solving styles of students.

Table 3

Covariance Analysis Test

Effect	Wilks' Lambda	F Value	df Hypothesis	df Error	Significance	Eta Squared
Group	0.29	9.36	15	254.37	0.0001	0.33

Summary Table of Covariance Analysis for Between-Group Effects

Source of Variation	Dependent Variable	Sum of Squares	Degrees of Freedom	Mean Square	F Ratio	Significance	Effect Size
Group Effect	Positive Orientation	89.31	3	29.77	20.21	0.0001	0.39
	Negative Orientation	642.8	3	214.27	23.28	0.0001	0.42
	Logical Style	236.36	3	78.787	18.16	0.0001	0.36
	Avoidant Style	497.04	3	165.68	22.66	0.0001	0.42
	Impulsive Style	576.56	3	192.187	20.78	0.0001	0.39
Error	Positive Orientation	141.44	96	1.473			
	Negative Orientation	883.36	96	9.202			
	Logical Style	416.4	96	4.337			
	Avoidant Style	701.92	96	7.312			
	Impulsive Style	888	96	9.25			

According to the data in Table 4, the statistical values related to the group effect on positive orientation (F = 20.21, sig = 0.0001), negative orientation (F = 23.28, sig = 0.0001), logical style (F = 18.16, sig = 0.0001), avoidant style (F =

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22.66, sig = 0.0001), and impulsive style (F = 20.78, sig = 0.0001) indicate that the group had a significant effect on the dependent variables. Therefore, it can be concluded that the experimental implementation of Tolman's and Bandura's theories had an impact on the problem-solving styles of the students.

4. Discussion and Conclusion

Considering that problem-solving styles include five styles: positive orientation, negative orientation, logical style, avoidant style, and impulsive style, the Scheffé test was used to compare the post-test of positive orientation, negative orientation, logical style, avoidant style, and impulsive style between two experimental groups based on Bandura's and Tolman's theories and the control group. The post-test mean scores for the groups trained under Tolman's and Bandura's theories in positive orientation were respectively 2.44 and 2.16 points higher than those of the control group, suggesting that problem-solving skills training based on Tolman's and Bandura's theories influences positive orientation in students and leads to an increase in students' positive orientation in problem-solving respectively (p = 0.001, i-j = 2.44 and 2.16, p = 0.0001). The difference between the mean scores of the groups trained under Bandura's theory and those trained under Tolman's theory in positive orientation is -0.28 (p = 0.88), indicating no significant difference between the impacts of training based on these two theories on students' positive orientation.

The post-test mean scores for the groups trained under Tolman's and Bandura's theories in negative orientation were respectively 7.04 and -4.12 points lower than those of the control group, indicating that problem-solving skills training based on Tolman's and Bandura's theories influences negative orientation in students and leads to a decrease in students' negative orientation (i-j = -7.04 and -4.12, p = 0.0001 for both). The post-test mean of the group trained under Bandura's theory is 2.92 points higher than that of the group trained under Tolman's theory in negative orientation, suggesting a difference in the impact of training based on Bandura's and Tolman's theories on negative orientation, with Tolman's training having a greater effect (i-j = 2.92, p = 0.012).

The post-test mean scores for the groups trained under Tolman's and Bandura's theories in logical style were respectively 3.92 and 3.4 points higher than those of the control group, indicating that problem-solving skills training based on Tolman's and Bandura's theories influences logical style in students and leads to an improvement in students' logical style (i-j = 3.92 and 3.4, p = 0.0001 for both). The difference between the mean scores of the groups trained under Bandura's theory and those trained under Tolman's theory in logical style is -0.52 (p = 0.85), indicating no significant difference between the impacts of training based on these two theories on students' logical style.

The post-test mean scores for the groups trained under Tolman's and Bandura's theories in avoidant style were respectively -5.8 and -4.72 points lower than those of the control group, indicating that problem-solving skills training based on Tolman's theory influences avoidant style in students and leads to a decrease in students' avoidant style (i-j = -5.8 and -4.72, p = 0.0001 for both). The difference between the mean scores of the groups trained under Bandura's theory and those trained under Tolman's theory in avoidant style is 1.08 (p = 0.57), indicating no significant difference between the impacts of training based on these two theories on students' avoidant style.

The post-test mean scores for the groups trained under Tolman's and Bandura's theories in impulsive style were respectively -6.7 and -3.92 points lower than those of the control group, indicating that problem-solving skills training based on Tolman's and Bandura's theories influences impulsive style in students and leads to a decrease in students' impulsive style (i-j = -6.7 and -3.92, p = 0.0001 for both). The post-test mean of the group trained under Bandura's theory is 2.84 points higher than that of the group trained under Tolman's theory in impulsive style, suggesting a difference in the impact of training based on Bandura's and Tolman's theories on impulsive style, with Tolman's training having a greater effect (i-j = 2.84, p = 0.016).

5. Discussion and Conclusion

The aim of this research was to compare the effectiveness of problem-solving skills training based on Tolman's and Bandura's theories on the problem-solving styles of middle school students. This study demonstrated that there are differences in the effectiveness of problem-solving skills training based on Tolman's and Bandura's theories across the styles of positive and negative orientation, logical style, avoidant style, and impulsive style, which aligns with previous research findings. Researchers have found relationships between learning strategies and their dimensions and problem-solving styles. Additionally, cognitive styles and their dimensions play a mediating role between learning strategies and problem-solving styles

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(Kozhevnikov, 2007). Training in cognitive-social problem-solving skills leads to a decrease in physicalization and emotion-focused strategies, and an increase in cognitive strategies, understanding of social support, and problem-solving, thereby reducing internal and external frustration in adolescent girls with risky behaviors. Cognitive-social problem-solving training enhances the use of positive coping strategies and reduces negative ones (Khakpour et al., 2021). Training in cognitive and metacognitive strategies is effective in increasing problem-solving skills and self-esteem in students (Purhossein et al., 2018). The behaviors exhibited by students are strong predictors of their states of cognitive engagement. Individuals with high performance in deep learning behaviors showed significantly higher levels of cognitive engagement than those with low performance (Lee et al., 2021). Students who were aware of their thinking processes when facing problems and learning tasks, who also trusted their problem-solving abilities, and those who reviewed and adjusted their performance when encountering a learning topic, and used the avoidant style less, experienced higher mental health and had a higher level of adaptability in dealing with their tasks (Klopp & Stark, 2020). Problem-solving training in schools enables students to improve their relationships and enhance their skills (Rogers et al., 2019). Problem-solving training enhances problem-solving skills and self-reliance in students (Ismuwardani et al., 2019). Training in problem-solving skills and effective communication increases adolescents' ability to solve problems and effectively use social supports (D'Zurilla & Nezu, 1990).

Furthermore, this study showed that problem-solving skills training based on Tolman's theory affected the five problem-solving styles: positive orientation, negative orientation, logical style, avoidant style, and impulsive style. This educational method increased the styles of positive and logical orientation and reduced the styles of negative, avoidant, and impulsive orientation (Isaksen et al., 2011). There is a significant difference in the impact of problem-solving skills training based on Bandura's and Tolman's theories on the negative and impulsive orientation styles of students. Problem-solving training based on Tolman's theory has a greater impact than training based on Bandura's theory on the two styles of negative and impulsive orientation. Training based on Tolman's theory reduces the use of negative and impulsive orientation styles in students more than training based on Bandura's theory. These findings are consistent with results from previous research (Andrews-Todd & Forsyth, 2020; Unal & Cakir, 2021). Considering the strengths of each of Bandura's and Tolman's learning theories in problem-solving skills training, it is suggested that research be conducted on designing an educational model that integrates these two theories. Problem-solving skills training based on the theories of Tolman and Bandura affects the five social problem-solving styles of students. These trainings increase the use of positive and logical orientation styles and reduce the use of negative, avoidant, and impulsive orientation styles in students. Often, there is a difference in the impact of training based on these theories on students' problem-solving styles. Training based on Tolman's theory has a greater impact on negative and impulsive problem-solving styles compared to training based on Bandura's theory.

6. Suggestions and Limitations

This study, while providing insightful contributions to the field of educational psychology, has several limitations that should be acknowledged. The primary limitation is the restriction of the sample to middle school students from a single geographical area, which may limit the generalizability of the findings to broader populations. Additionally, the study utilized only quantitative methods to measure the effectiveness of problem-solving training, which may not fully capture the nuanced cognitive and emotional changes in students. Furthermore, the reliance on self-reported measures for assessing problem-solving styles could introduce bias, as participants might respond in ways they perceive as socially desirable rather than reflective of their actual practices.

Future research could expand on the findings of this study by including a more diverse sample that spans different age groups, educational levels, and cultural backgrounds to enhance the generalizability of the results. Employing a mixed-methods approach could also provide a more comprehensive understanding of how students perceive and benefit from problem-solving training, incorporating qualitative data through interviews or focus groups. Additionally, longitudinal studies would be beneficial to assess the long-term impacts of cognitive-social problem-solving training on students' academic and personal development, providing insights into the sustainability of the skills acquired through such training.

The findings of this study suggest practical implications for educational policy and classroom practices. Schools

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should consider integrating problem-solving training into their curricula, emphasizing both cognitive and social strategies to enhance students' overall problem-solving abilities. Teacher training programs could also incorporate modules on effective problem-solving techniques based on Tolman's and Bandura's theories to equip educators with the necessary skills to foster a supportive learning environment. Additionally, educational policymakers could support the development of intervention programs that address specific problem-solving styles, promoting more adaptive coping strategies among students. These implementations could contribute to improved educational outcomes and better emotional and social well-being for students.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

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

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