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The Role of Problem-Solving Strategy in Developing Thinking Skills Among Middle School Students (A Field Study from the Perspective of Natural Sciences Teachers in the City of Laghouat)

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Abstract:

The article aims to study the role of the problem-solving strategy in developing thinking skills among middle school students, with a focus on natural sciences in the city of Laghouat. The study adopted a descriptive-analytical approach, collecting data through a questionnaire directed at a sample of 47 teachers. The results revealed that the problem-solving strategy significantly contributes to enhancing students' analytical and creative thinking through its various stages, including problem awareness, problem identification, hypothesis formulation, data collection, and reaching conclusions. The study also emphasized the importance of the teacher's role in guiding students through these stages, which enhances their self-learning abilities and refines their higher-order cognitive skills. The study concluded that implementing this strategy in educational curricula is essential to fostering creativity and developing students' thinking, with a recommendation to train teachers on its effective application.

Keywords: Problem-solving strategy, thinking development, middle school education, natural sciences.

1. Introduction

Education constitutes the fundamental pillar for the advancement of societies and an essential criterion for measuring the progress of nations. The primary objective of the educational process is no longer limited to the mere acquisition of quantitative knowledge but has extended to include refining intellectual abilities and developing thinking skills in learners, enabling them to become active participants in their environment. Stemming from this transformation, educational curricula have witnessed a revolution in teaching strategies,

shifting from "rote teaching," which stuffs minds with information, to "learner-centered education" that focuses on higher cognitive levels and performance competencies.

The problem-solving strategy stands out as one of the most prominent modern approaches that places the learner in confrontation with situations requiring analysis, organization, and inquiry, thereby granting them the opportunity to construct their own knowledge effectively and actively. The subject of natural sciences emerges as an ideal environment for applying this strategy, given its experimental nature and deductive logic that stimulates the mind to confront and deconstruct scientific challenges.

2. Problem Statement

Despite the development witnessed by the educational system, some traditional practices that emphasize memorization and rote learning still cast their shadow over teaching performance, potentially stifling creative faculties and hindering students' mental abilities. Previous studies (such as those by Kamli and Bouchwarb) have emphasized the need to shift education from a mere verbal process to an experience encompassing the cognitive and sensory aspects of the learner.

Accordingly, this study seeks to investigate the role of the problem-solving strategy in developing thinking among middle school students through observing and analyzing the opinions of natural sciences teachers in the city of Laghouat, as they are the direct practitioners of this process.

Study Questions:

- Main Question: Does the use of the problem-solving strategy contribute to developing thinking among middle school students from the perspective of natural sciences teachers?
- Sub-Questions: Do the skills (sensing the problem, defining it, formulating hypotheses, collecting data, and reaching conclusions) contribute to enhancing learners' intellectual abilities?

3. Objectives and Significance of the Study

Objectives of the Study:

- Analyze the impact of teaching natural sciences using the problem-solving strategy on developing mental skills.
- Identify the extent to which each stage of problem-solving contributes to elevating the level of thinking.
- Reveal the structural characteristics of the problem-solving strategy within the Algerian educational context.

Significance of the Study:

- For curriculum designers: Providing insights into how to construct instructional units based on inquiry and problem-solving.

- For teachers: Offering a procedural guide on employing this strategy and tools for assessing thinking skills.
- For learners: Transforming them from passive recipients into researchers and thinkers equipped with self-learning tools.

4. Conceptual and Operational Definitions

- Problem-Solving Strategy: Operationally, it is a structured educational plan that prompts the student to recall prior experiences and employ analytical skills to arrive at solutions for new educational situations; it is measured by the student's efficiency in performance tests.
- Thinking: A flexible mental skill that can be developed through training (De Bono); operationally, it is the ability to process information efficiently to produce innovative ideas suited to real-life challenges.
- Natural Sciences Subject: An educational methodology focused on studying physical and biological phenomena through interaction between teacher and learner using scientific inquiry methods.

5. Literature Review and Previous Studies

The review of prior studies forms a foundational pillar for understanding the dimensions of the current problem. Research approaches to the problem-solving strategy and its relationship to cognitive processes have varied and can be classified as follows:

- **First: Arabic Studies**
- Bouchehir and Ghattas (2020): This exploratory study aimed to examine the correlational relationship between employing the problem-solving strategy and developing creative thinking among fifth-year primary students. Applying Torrance's verbal and figural scales to a sample of 35 students, the results revealed a positive and statistically significant correlation, with gender differences favoring females in creative abilities.
- Riad Ahmed Mohammed Naaman (2016): This study focused on measuring the effect of "creative problem-solving" in teaching science to sixth-grade basic students. Using a quasi-experimental design on a sample of 55 students, the results demonstrated the strategy's effectiveness in enhancing inductive thinking and developing tangible positive attitudes toward the scientific subject.
- Diab (2005): This study aimed to investigate the effect of "activity portfolios" on developing scientific

thinking and retention of learning among seventh-grade female students. Results (using t-test) showed superiority of groups exposed to active strategies compared to traditional methods, confirming their value in developing higher mental skills.

Second: Foreign Studies

- Wynne (2001): This study addressed the effect of the problem-solving strategy on understanding complex biological concepts (genetics) among secondary school students. Results showed substantial improvement in students' ability to analyze and connect scientific concepts, proving the strategy's effectiveness in natural sciences disciplines.
- Case (1996): This study compared teaching based on creative problem-solving with conventional methods. Although no significant differences were found in overall creative efficiency between experimental groups, the study confirmed clear superiority of problem-solving groups over the control group that relied on rote learning.

Third: Analytical Commentary on Previous Studies

Through critical examination of the aforementioned studies, points of convergence and divergence with the current study can be derived as follows:

1. Methodological and Procedural Comparison

Aspect of Comparison	Previous Studies	Current Study
Research Environment	Varied between Arabic (Algeria, Yemen) and foreign (USA, UK) contexts	Conducted in the Algerian context (City of Laghouat)
Scientific Methodology	Predominantly experimental and quasi-experimental	Employs descriptive-analytical methodology
Study Sample	Mostly focused on students (ranging from 19 to 192)	Targets teachers as a purposive expert sample (47 teachers)
Tools	Varied (intelligence tests, attitude scales, training portfolios)	| Relies primarily on a questionnaire for data collection

Fourth: Research Distinctiveness of the Current Study

The present study intersects with prior literature in emphasizing the centrality of problem-solving as a tool for developing thinking. However, it uniquely offers an evaluative perspective from practitioners (teachers) in the middle school stage, with a qualitative focus on

the natural sciences subject, thereby providing results with a field dimension that bridges educational theory and classroom practice.

6. Methodological Framework of the Study

Given the nature of the outlined objectives, the descriptive methodology was adopted as the optimal scientific approach for investigating educational phenomena as they exist in reality. This methodology does not merely describe the phenomenon superficially but extends to analyzing, classifying, and linking its variables to reach scientifically valuable generalizations.

❖ **Population and Sample**

- **Original Population**: All natural sciences teachers in middle schools in the city of Laghouat.
- **Sample**: A purposive sample of 80 male and female teachers was selected due to their greater familiarity with implementing the competency-based approach and problem-solving strategies in the field. Actual responses were received from 47 teachers, providing a sufficient database for statistical analysis.

❖ **Study Instrument (Questionnaire)**

To achieve maximum accuracy, an adapted questionnaire (based on Rekrok Mariam, 2018) was adopted after alignment with the current study's context. The questionnaire follows a three-level progression (always, sometimes, never), allowing precise detection of differences in respondents' opinions regarding the strategy's role in developing thinking levels (sensing the problem, hypothesizing, verification, and reaching conclusions).

Scoring System:

The study used a three-point Likert scale for scoring responses, as shown in the following table:

Table (03): Distribution of Scoring Weights for the Study Instrument

Response	Always	Sometimes	Never
Weighted Score	3	2	1

(Source: Rekrok Mariam, 2018, p. 50)

❖ **Psychometric Properties of the Instrument (Validity and Reliability)**

To ensure result accuracy, the questionnaire's psychometric properties were examined using the Statistical Package for the Social Sciences (SPSS 25). Reliability was verified by calculating Cronbach's alpha, yielding an overall value of 0.795. This value is a strong indicator of the instrument's quality and internal consistency, confirming its validity and suitability for field application.

❖ **Statistical Methods Employed**

Data were processed using SPSS 25 with the following statistical techniques:

- Arithmetic mean: To describe the central value of sample responses.
- Standard deviation: To measure the dispersion and homogeneity of opinions around the mean.
- Cronbach's alpha: To confirm the reliability of questionnaire items.
- Frequencies and percentages: To provide an accurate description of demographic and professional characteristics of the sample.

7. Presentation and Analysis of Results

After conducting the field application and distributing 80 questionnaires to natural sciences teachers in middle schools in Laghouat, 47 valid questionnaires were retrieved for analysis. Table (04) illustrates the achieved response rate:

Table (04): Number of Obtained Responses

Category	Number	Percentage (%)
Study Sample	80	100
Responses	47	58.75

5. Presentation of Results Related to Personal Data

First: Gender (SPSS 25 Output)

Table (05): Results Related to Gender

Gender	Frequency	Percentage (%)
Male	4	8.5
Female	43	91.5
| Total	47	100

Comment: The results show that the majority of natural sciences teachers in the sample are female (91.5%), while males represent a small proportion (8.5%).

Second: Professional Experience Variable

Table (06): Distribution of Teachers by Years of Experience

Professional Experience	Frequency	Percentage (%)
Less than 5 years	6	12.8
5–10 years	22	46.8
More than 10 years	19	40.4
Total	47	100

Comment: The data indicate that the most represented category is teachers with medium experience (5–10 years) at 46.8%, followed by those with long experience (more than 10 years) at 40.4%. This reflects that most sample members possess sufficient knowledge and field experience to evaluate teaching strategies.

Third: Academic Qualification Variable

Table (07): Results Related to Academic Qualification

Academic Qualification	Frequency	Percentage (%)
Bachelor's (Licence)	7	14.9
Master's	31	66
PhD	0	0
Higher School	9	19.1
Total	47	100

Comment: The largest proportion of teachers hold a Master's degree (66%), indicating a high academic level that contributes to understanding and applying modern approaches such as problem-solving.

8. Presentation and Analysis of Study Hypotheses Results

8.1 Results of the First Sub-Hypothesis

Hypothesis Statement: "Students' ability to sense the problem contributes to developing their thinking."

Table (08): Arithmetic Means and Standard Deviations for Items of the First Axis (Sensing the Problem)

Axis	Item No	Item Statement	Arithmetic Mean	Standard Deviation	Degree
Sensing the Problem	01	When I make the student sense a problem, I encourage them to think deeply about its nature	2.62	0.491	High
	02	I contribute to sensitizing students to the problem to help them remember it in the future	2.62	0.534	High

	03	When students feel motivated to solve the problem, it increases their lesson comprehension	2.70	0.462	High
	04	When I make students feel self-confident in solving the problem, it develops their thinking level	2.70	0.462	High
	05	I contribute to sensitizing students to the existence of the problem through discussion to develop thinking	2.79	0.414	High
	06	I sensitize students to the importance of the problem to help improve their thinking level	2.70	0.462	High
	07	I boost students' morale to sensitize them to a problem requiring solution to develop their thinking	2.57	0.500	Medium
Overall Axis Value			2.67	0.475	High

Comment and Analysis: The overall response on the "sensing the problem" axis was high (overall mean 2.67). Item 05 (opening discussion) achieved the highest mean (2.79), confirming classroom dialogue as the strongest tool for stimulating the learner's mind. Items related to motivation, self-confidence, and problem importance ranked high (2.70), while boosting morale received a medium score (2.57).

Conclusion: The first sub-hypothesis is supported in the field.

Interpretation: This high response (2.67) is explained by the fact that awareness of an obstacle represents the initial spark for motivation and intellectual challenge. Shaker Mahmoud Al-Amin (1992, p. 54) considers this step essential for attracting attention and stimulating thinking. This aligns with Rekrok (2018), which showed that sensing the problem not only develops thinking but also directly improves academic achievement.

8.2 Results of the Second Sub-Hypothesis

Hypothesis Statement: "Students' ability to define the problem contributes to developing their thinking."

Table (09): Arithmetic Means and Standard Deviations for Items of the Second Axis (Defining the Problem)

Axis	Item No	Item Statement	Arithmetic Mean	Standard Deviation	Degree
Defining the Problem	01	I select a problem suited to students' level to help elevate their thinking	2.79	0.414	High
	02	I present illustrative images to aid problem analysis for thinking development	2.43	0.683	Medium
	03	I choose a previously unaddressed problem to enrich their knowledge base	2.51	0.505	Medium
	04	I train students to identify the problem's objective to elevate thinking	2.68	0.471	High
	05	I plan for problem definition to develop thinking and improve achievement	2.74	0.441	High
	06	I identify obstacles students face during problem definition to enhance cognitive skills	2.74	0.441	High
	07	I train students to diagnose the current problem situation to elevate cognitive level	2.53	0.504	Medium
Overall Axis Value			2.63	0.494	High

Comment: Selecting a level-appropriate problem achieved the highest mean (2.79), followed by planning and identifying obstacles (2.74). The second sub-hypothesis is supported.

Interpretation: With a mean of 2.63, clear problem definition encourages focused study. Shaker Mahmoud Al-Amin (1992, p. 54) states that without defining the problem and its

dimensions, the strategy cannot succeed. This aligns with Rekrok (2018).

8.3 Results of the Third Sub-Hypothesis

Hypothesis Statement: "Students' ability to formulate hypotheses contributes to developing their thinking."

Table (10): Arithmetic Means and Standard Deviations for Items of the Third Axis (Formulating Hypotheses)

Axis	Item No	Item Statement	Arithmetic Mean	Standard Deviation	Degree
Formulating Hypotheses	01	| I train students to propose temporary solutions to develop thinking	2.87	0.397	High
	02	When students formulate hypotheses from prior experiences, it elevates thinking	2.62	0.534	High
	03	When students select appropriate hypotheses, it develops thinking	2.77	0.428	High
	04	I ask students to formulate hypotheses through discussion to increase knowledge	2.68	0.471	High
	05	I ask students to follow some hypotheses through experimentation to improve thinking	2.57	0.542	Medium
	06	| I train students to verify hypothesis validity to elevate thinking levels	2.74	0.441	High
Overall Axis Value			2.70	0.469	High

Comment: Training on temporary solutions achieved the highest mean (2.87). The third sub-hypothesis is supported.

Interpretation: Hypothetical thinking is central to the scientific method. Teacher guidance in verification prevents thinking inhibition, supporting Rekrok (2018).

8.4 Results of the Fourth Sub-Hypothesis

Hypothesis Statement: "Students' ability to collect information contributes to developing their thinking."

Table (11): Arithmetic Means and Standard Deviations for Items of the Fourth Axis (Collecting Information)

Axis	Item No	Item Statement	Arithmetic Mean	Standard Deviation	Degree
Collecting Information	01	I divide students into groups for data collection to maximize information exchange	2.55	0.503	High
	02	I guide students to collect data from books to develop thinking	2.60	0.538	High
	03	I guide students to the internet for data collection to gather maximum information	2.23	0.633	Medium
	04	I guide students to collect data through observation to elevate thinking levels	| 2.70	0.462	High
	05	I guide students to reliable sources to enrich knowledge	2.64	0.568	High
	06	I guide students to classify and tabulate data to elevate thinking	2.51	0.621	High
Overall Axis Value			2.54	0.554	High

Comment: Guidance toward observation achieved the highest mean (2.70). Internet guidance was medium (2.23). The fourth sub-hypothesis is supported.

Interpretation: Information search enriches knowledge and reveals relationships between facts (Shaker Mahmoud Al-Amin, 1992, p. 54).

Guidance toward reliable sources prevents passive thinking, aligning with Rekrok (2018).

8.5 Results of the Fifth Sub-Hypothesis

Hypothesis Statement: "Students' ability to reach conclusions contributes to developing their thinking."

Table (12): Arithmetic Means and Standard Deviations for Items of the Fifth Axis (Reaching Conclusions)

Axis	Item No	Item Statement	Arithmetic Mean	Standard Deviation	Degree
Reaching Conclusions	01	I assist students during problem-solving to elevate their cognitive level	2.60	0.577	High
	02	I help formulate problem results to demonstrate thinking levels	2.72	0.498	High
	03	I train students to provide supporting evidence for conclusions to show thinking level	2.68	| 0.471	High
	04	I reward students upon reaching conclusions to continue developing thinking	2.64	0.529	High
	05	I point out students' errors during problem-solving to help develop thinking	2.87	0.337	High
Overall Axis Value			2.70	0.482	High

Comment: Pointing out errors achieved the highest mean (2.87). All items were high. The fifth sub-hypothesis is supported.

Interpretation: Conclusion formulation represents the cognitive outcome. Reward and error correction turn results into generalizable principles, aligning with Rekrok (2018).

9. Presentation and Analysis of the General Hypothesis Results

Hypothesis Statement: "The use of the problem-solving strategy contributes to developing thinking among middle school students from the perspective of natural sciences teachers."

Overall Results Table

General Hypothesis	Arithmetic Mean	Standard Deviation	Degree
The use of the problem-solving strategy contributes to developing thinking among middle school students from the perspective of natural sciences teachers	2.65	0.494	High

Comment: Teachers overwhelmingly agree on the strategy's effectiveness (overall mean 2.65, high). The general hypothesis is supported.

Interpretation: Consensus stems from observable field benefits, making thinking a visible, organized process practiced confidently.

10. General Discussion

Linking results to educational literature shows that the problem-solving strategy develops intellectual abilities and enhances creativity and innovation, enabling learners to construct knowledge autonomously (Samia Mohamed Mahmoud Abdullah, 2015, p. 197). It also accommodates individual differences and helps link prior and new knowledge (Afaf Othman Mustafa, 2014, p. 262).

The current findings confirm Jaarit and Namour (2020) regarding the strong correlation between this strategy and thinking development, especially in natural sciences, which inherently rely on observation, experimentation, and deduction.

11. General Conclusion

This study aimed to investigate the role of the problem-solving strategy in developing thinking among middle school students from teachers' perspectives. Based on statistical processing using SPSS 25, the study concludes:

1. The use of the problem-solving strategy contributes to a high degree in developing thinking.
2. All strategy stages (sensing, defining, hypothesizing, collecting information, and reaching conclusions) received high evaluations for their contribution to refining student skills.
3. The study proves that transitioning from traditional methods to active strategies is the cornerstone for liberating learners' minds and opening avenues for innovation.

Final Note: Despite positive indicators, these results are bound by the study's sample and context, opening the door for future studies addressing other variables to strengthen research in this vital educational field.

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