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The Effectiveness of a Proposed Teaching Strategy Based on the Renzulli Model Supported by the GeoGebra and Desmos Programs on the Probing Thinking skills of Secondary School Female Students in Mathematics

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Abstract

The objective of the study was to determine the efficacy of a teaching strategy that was based on Renzulli's model and was facilitated by the Desmos and GeoGebra programs in the development of the probing thinking skills of secondary school students in mathematics. The researchers employed the experimental method and experimental design for two samples that were equivalent in certain variables, in accordance with the research objectives. The complete sample comprised of (60) female students, with (30) in each group. The experimental group was instructed in accordance with Renzulli's model, while the control group pursued their studies in the conventional manner. A Probing thinking skills test was developed and administered to the two groups. The test consisted of twenty paragraphs, thirteen of which were objective and seven of which were essay-based. The experimental group outperformed the control group, as indicated by the results.

Keywords: Effectiveness, Strategy, Renzulli Model, GeoGebra and Desmos Programs, Probing Thinking skills, Secondary School, Female Students, Mathematics.

Introduction

First: The Research Problem

The world has witnessed rapid cognitive and technological development, which has forced educational systems to adopt modern teaching methods that keep pace with contemporary demands and enable new generations to meet its changing challenges. (Hassan, 2023, p. 55). The use of technology in education is one of the most prominent of these modern methods, as it provides interactive learning environments and multimedia that contribute to simplifying concepts and enhancing understanding, especially in abstract subjects such as mathematics. Digital tools help support interaction and increase student motivation. The recommendations of the 15th International Conference on Mathematics Education (ICME-15), held in Sydney, Australia, from July 7 to 14, 2024, emphasized the importance of integrating technology into mathematics education to improve the quality of learning and develop classroom practices. Despite these trends, educational practices show weakness in the use of probing thinking strategies, as the results of a questionnaire revealed that large percentages of teachers do not use questions or activities that stimulate these skills. The percentage of those who do not link questions to sensory experiences reached (78%), those who do not train students to formulate

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generalizations (72%), and those who do not push them to issue conclusions (82%). The percentage also reached (74%) in not encouraging the formulation of hypotheses, and (80%) in not linking learning to new situations.

These percentages indicate that the shortcomings in the educational environment are not related to weak student abilities, but rather are attributable to the absence of effective teaching methods that tap into students' potential and develop their intellectual skills. Relying on traditional practices and failing to consider different thinking styles limits the effectiveness of education in developing probing thinking and promoting deep understanding. From this perspective, the researchers seek to employ a teaching strategy based on the Renzulli model, which provides a stimulating and interactive environment that takes into account individual differences and contributes to developing students' abilities and thinking skills. Based on the above, the research problem is defined in the following question:

What is the effectiveness of a teaching strategy based on the Renzulli model, supported by Desmos and GeoGebra, on the probing thinking skills of secondary school female students in mathematics?

Second: The Importance of the Research

1. A teaching strategy based on the Renzulli model, applicable within classrooms, helps teachers diversify learning methods to enhance mathematical communication (Al-Yasiri et al., 2013, p. 285).
2. It presents pre-prepared lesson plans for the first part of the fourth scientific grade curriculum. The researchers followed the teaching strategy and how to apply it in the teaching field (Ghali and Hassan, 2023, p. 297).
3. Probing thinking skills are among the skills that help learners analyze their ideas and generate new solutions, which contributes to understanding mathematics and solving problems effectively (Jawad & AlRikabi, 2021, p. 173).
4. Mastering Probing thinking skills helps learners search for, organize, and categorize knowledge within appropriate retrieval tables (Majid, 2020) (Hammadi, 2023).
5. The research emphasizes the importance of linking mathematical concepts to real-life contexts, as this plays a role in adding meaning to the knowledge students acquire and enhancing deep understanding. For mathematical concepts (Majeed, 2022, p. 214).

Third: Research Objective The aim of the research is to identify the effectiveness of a teaching strategy based on the Renzulli model, supported by Desmos and GeoGebra, on the probing thinking skills of secondary school students.

Fourth: Research Hypothesis "There is no statistically significant difference at the significance level (0.05) between the average scores of students in the experimental group, who will be taught the prescribed material from the mathematics textbook using the proposed teaching strategy based on the Renzulli model, and the scores of students in the control group, who will be taught the same material using the traditional method, in the probing thinking skills test."

Five: Research Limits

1. 4th scientific class students in government daytime secondary and preparatory schools affiliated

with the General Directorate of Education in Baghdad Governorate/ Karkh I for the first semester of the 2024/2025 academic year.

2. Contents of the first four chapters (Mathematical Logic, Equations and Inequalities, Bases and Roots, Trigonometry) of the mathematics textbook prescribed for Fourth scientific class students for the 2024/2025 academic year, thirteenth edition, 2021, by the Ministry of Education, Republic of Iraq.

3. Steps of the proposed teaching strategy based on the Renzulli model supported by the Desmos and GeoGebra programs (exploratory activities, discussion (presentation and explanation), group practice activities, real-world problems, and feedback).

4. Probing thinking skills (concept comprehension, information interpretation, and principle application).

Sixth: Defining Terms

Effectiveness: is "The extent to which the system's outputs match its objectives, or the ability to achieve the desired goals and achieve the desired results" (Zaytoun, 2001, p. 37).

The researchers define it procedurally as the impact of the proposed teaching strategy on the academic level of fourth-grade science students and their ability to master probing thinking skills. This is measured through the results of tests designed for this purpose.

Teaching Strategy: is "A set of actions undertaken by the teacher within the classroom, which occur in an organized and sequential manner and aim to achieve pre-established teaching objectives." (Al-Kubaisi, 2015, p. 94).

The researchers define it procedurally as the set of steps and procedures adopted by the researchers to organize and present mathematics content to fourth-grade science students according to a planned sequence, with the goal of raising their academic level.

The Renzulli Model (Renzulli, 1994) defines it as: "An integrated educational plan designed to overcome the problems of gifted students within regular classrooms. This plan is based on the concept of the three rings of giftedness: above-average intellectual ability, creative ability, and commitment to the task. This plan is presented in the form of enrichment activities that pass through three stages: general exploratory activities, training activities, and research activities" (Renzulli, 1997, pp. 37-38).

The researchers define it procedurally as an organized teaching plan prepared by the researchers, which includes educational steps and activities implemented according to stages based on the Renzulli model, and includes: general exploratory activities, discussion (presentation and explanation), group exercises, and performance evaluation. This strategy was applied in teaching mathematics to fourth scientific grade students with the aim of achieving educational objectives.

GeoGebra is defined as: "An open-source, dynamic mathematics program that combines geometry, algebra, and calculus in a multi-window interface. It serves as a comprehensive interactive teaching tool that supports graphing and equations. It is designed to be accessible to both teachers and students." (Hohenwarter & Lavicza, 2007, p. 92) (ALRikabi, H. (2024).

The researchers define it procedurally as an interactive educational tool that the researchers used to teach mathematical concepts to fourth scientific grade students, by representing mathematical relationships graphically and dealing with shapes and equations within a dynamic environment

that contributes to simplifying the content and enhancing visual understanding.

Desmos is a free graphing calculator that works as a browser-based application and as a mobile application. It has extensive capabilities and the ability to draw various shapes (Chechen et al., 2023, p4).

The researchers define it procedurally as: an interactive tool that was used in teaching functions to fourth scientific grade students, to draw equations graphically and simplify mathematical concepts within the steps of the teaching strategy during the experiment period.

Probing thinking is defined as: "An advanced mental process employed in diverse fields, enabling the learner to leverage academic content to develop their knowledge, experiences, and ideas, enabling them to generate new ideas, subject them to analysis and evaluation, with the goal of improving their performance and reaching the stage of creativity" (Al-Ayasrah, 2011, p. 190).

The researchers define it procedurally as: the ability of fourth-grade science students to engage in advanced mental processes, including comprehending mathematical concepts, interpreting information and data, and applying principles, when they employ these skills in educational situations. This is measured through their performance on the probing thinking skills test developed by the researchers.

Literature Review

First: Theoretical Background

Renzulli Model: The Renzulli Model is an educational model designed to identify and nurture gifted and talented students. It resulted from the combination of the Triple Enrichment Model and the Revolving Door Model (Renzulli & Rice, 2015, p. 26). It is a model applicable to regular schools, allowing all students to benefit from gifted programs (Al-Qamash, 2011, p. 258). Stages of the Renzulli Model are:

1. **General Exploratory Activities:** This level is offered to all students, including regular students, through exploratory activities exploring new knowledge, implemented using traditional curricula and diverse knowledge sources. The goal is to expand experiences and guide students toward interests that will lead them to the next level (Essa, 2018, p. 224).
2. **Group Training Activities:** This level includes group training activities that also involve regular students (Renzulli and Rice, 2015, p. 136). These activities aim to train students in higher-order thinking skills, problem-solving, and written, oral, and visual communication skills (Al-Quraiti, 2014, p. 327).
3. **Authentic Problems:** At this level, students work individually or in small groups to explore realistic problems by identifying and analyzing them, fostering creativity and commitment, and supporting advanced understanding of the course content (Sally et al., 2008, p. 4).

The researchers developed a proposed educational strategy based on Renzulli's enrichment model, where the strategy was designed according to its three stages.

Proposed Strategy Steps:

Step one/ Exploratory Activities Phase: In this phase, activities are presented designed to

activate learners' prior knowledge and connect it to new targeted concepts. These activities are not included in the traditional curriculum and enable learners to discover concepts and principles on their own.

Step Two/ Discussion (Explanation and Clarification) (Suggested): This includes providing a detailed explanation of the concepts explored, with a comprehensive presentation of the lesson and clarification of its basic elements, using interactive applications such as “Demos” and “GeoGebra” to illustrate abstract concepts, with the aim of consolidating a deep understanding and applying the concepts in diverse contexts.

Step Three/ Group Exercises: This stage includes activities to develop higher-order thinking skills, such as analyzing and evaluating problems, understanding and applying relationships between concepts, while encouraging collaborative work to exchange ideas and enhance communication and teamwork.

Step Four/ Performance Assessment: This stage focuses on assessing learners' performance through interactive activities implemented individually or in groups, using worksheets or electronic educational games. These activities are designed to motivate learners to research, analyze, and apply knowledge, thus helping to measure their mastery of acquired skills.

Step Five/ Feedback (Suggested): In this stage, learners are provided with feedback on their performance to identify and enhance strengths and address weaknesses, thus enhancing self-learning, motivation, and performance.

Desmos Program: is an interactive mathematics program that works online or through smart device applications, providing a visual environment for learning mathematics. Founded in 2011 in the United States, it is characterized by its ease of use and multiple tools, such as a toolbar and algebra and graphing windows. It allows for the entry of equations and immediate visualization of their graphs. It is free and globally available. It aims to support students' learning of mathematics through flexible and interactive technological means (Al-Kanani and Al-Saadi, 2023, p. 35).

GeoGebra Program: is an interactive educational software that supports mathematics learning through a dynamic environment that combines algebra, geometry, and visual representations (Marsal, 2017, p. 17). The program enables exploratory activities that promote self-learning through experimentation and discovery (Abu Thabet, 2013, p. 43). It is used to display numerical, algebraic, and geometric representations through windows such as the Algebra and Geometry window and the Command Bar. It also helps the teacher provide guidance and allow the student to reach solutions in a logical manner (Ahmed, 2013, p. 32).

The researchers believe that the proposed educational stages represent an effective educational sequence that contributes to achieving deeper learning, as they allow for the exploration of the concept through activities that activate prior knowledge and stimulate thinking. The structured explanation enhances understanding using interactive tools, while group work consolidates learning and develops communication skills. Real-life situations provide an opportunity to employ knowledge, and feedback supports performance evaluation and development, thus enhancing academic growth.

Probing Thinking: Probing thinking is a type of thinking associated with cognitive orientation. It is viewed as a complex mental process that encompasses higher mental skills, such as generating, analyzing, and evaluating ideas, and enhancing one's cognitive structure (Abdul Aziz, posthumanism.co.uk

2009, p. 121). probing thinking encompasses multiple cognitive processes that contribute to the development of higher mental abilities, such as memory, analysis, reasoning, deduction, and induction. Its nature is determined by the needs of the mind and the depth of the cognitive material (Hassan and Muhammad, 2020, p. 77).

Probing thinking is linked to cognitive structures and mental representations in information processing. It consists of two domains: process, which is the mental activity an individual, engages in to understand and integrate experiences; and content, which includes the knowledge and information that influence the effectiveness of mental processes (Al-Ayasrah, 2011, p. 492). It is considered a characteristic of mental maturity, enabling the individual to analyze phenomena in depth, granting them a prestigious social status, and its educational importance is evident in transforming the learner from a passive recipient to an active participant in their environment (Abdul Aziz, 2013, p. 124).

Probing Thinking Skills:

Concept Comprehension Skill: aims to develop learners' concepts from the concrete to the abstract, by organizing information and seeing the relationships between them (Hassan and Muhammad, 2020, p. 78).

Sub-skills:

- Enumeration and Recall: Relies on the use of the senses for deeper engagement with experiences.
- Categorization: Grouping materials based on common characteristics.
- Labeling and Naming: Reorganizing elements and naming the group according to new criteria. (Abu Zaid and Salah, 2022, pp. 142–152)

Information Interpretation Skill: Means understanding the meanings of concepts by describing, linking, and analyzing them using interpretation, inference, and generalization (Qatami, 2014, p. 526).

Sub-skills:

- **Identifying key relationships:** Linking and explaining things by understanding the relationships between them.
- **Discovering new relationships:** Searching for connections between concepts to explain them. (Al-Ayasrah, 2011, pp. 118-121)
- **Drawing inferences:** Reaching conclusions using logic and inductions based on previous experiences (Al-Ayasrah, 2015, p. 501).

Principle Application Skills: This involves summarizing experiences in a simple statement or specific principles for the purpose of comprehending, storing, and applying them in the student's environment. It includes.

Sub-skills:

- **Hypothesis Formulation:** Formulating hypotheses based on the collected information
- **Hypothesis Validation:** Testing the hypothesis and confirming its validity

- **Generalization:** Arriving at conclusions and generalizing them. (Razouqi, 2019, pp. 212-213)

Both researchers believe that probing thinking represents a cognitive framework that contributes to developing learners' abilities to understand, analyze, and reason. They emphasize that activating its core skills—understanding the concept, interpreting information, and applying principles—enhances the depth of learning and helps learners engage consciously with knowledge.

Second: Previous Studies

Researcher	Specialization	Methodology	Independent Variable	Dependent Variable	Educational Level	Sample Size and Gender	Tools	Statistical Tools	Results
Hassan & Mohammed, 2020	Mathematics	Experimental	Thinking level questions	probing thinking and mathematical achievement	University	100 male and female students	probing thinking test	SPSS v23	A statistically significant difference was found between the mean scores of the two groups in both the achievement test and the probing thinking test, in favor of the experimental group.

Table 1. Previous Studies that dealt with the variable of probing thinking

Research Methodology and Procedures

First: Research Methodology and Design: Researchers adopted an experimental design for two equivalent groups (experimental and control) with a post-test, as it was appropriate for the nature of the research (Jassim, 2024); (Hammadi, 2023) as shown in table (2).

Group	Equivalencies	Independent Variable	Dependent Variable	Tools
Experimental	- Prior knowledge - probing thinking skills	Instructional strategy based on Renzulli model	Probing thinking skills	probing thinking skills test
Control	- Intelligence	Traditional method		

Table 2. Experimental design of the research

Second: The research community, its sample, and control procedures: The community consisted of all 4th scientific class female students/ government daytime secondary schools/ Baghdad; Karkh 1st Education Directorate/ academic year 2024-2025 AD. Al-Khadhra Secondary School for Girls was randomly selected to represent the research sample, as Section (B) was designated as an experimental group comprising (35) female students, and Section (C) as a control group comprising (34) female students, with the exclusion of (9) female students

who failed from the statistical analysis while continuing to attend the class.

To ensure the integrity of the experimental design, the researchers verified internal validity by verifying the equivalence of the two groups in the variables of probing thinking skills, prior knowledge, and intelligence. This was achieved by calculating arithmetic means and standard deviations, applying Levene's test for homogeneity of variance, and a t-test for two independent samples to verify the absence of statistically significant differences between the two groups before the experiment. External validity was achieved by standardizing the experimental conditions between the two groups in terms of duration (10/6/2024 to 1/5/2025), subject matter (the first four chapters of the mathematics book, 13th edition, 2021), teaching the two groups by the researchers, and adhering to the official weekly schedule of four classes per week for each class as in table 3.

Variables	Group	Np. of Students	Mean	SD	F	Levene's Sig. (p)	t-Value	Significance Level (p)
Prior Knowledge	Exp.	30	7.3000	1.87819	3.759	0.057	0.816	0.418 (Not Significant)
	Con.	30	6.8333	2.50631				
Intelligence	Experimental	30	19.2667	6.88293	0.016	0.899	0.851	0.398 (Not Significant)
	Control	30	17.7667	6.77054				
Probing Thinking Skills	Experi.	30	4.5000	1.40810	4.551	0.037	1.346	0.184 (Not Significant)
	Cont.	30	4.9667	1.88430				

Table 3. Statistical description of equivalence variables

Third: Research Requirements

- **Defining and Analyzing the Scientific Material:** The scientific material consisted of the content of the first four chapters of the mathematics textbook for the fourth grade of science. This content was analyzed according to the components of mathematical knowledge: concepts, generalizations, skills, problem-solving, and thinking styles.
- **Formulating Behavioral Objectives:** These were formulated according to Bloom's taxonomy of the cognitive domain, and after being evaluated, they reached (191) objectives.
- **Preparing Curricula:** (46) curriculum plans were prepared for each group to cover the four chapters.

Fourth: Research tool: Constructing a probing thinking skills test consisting of (20) paragraphs was constructed, formulated according to the main skills of probing thinking and its sub-skills, and distributed as follows: (13) multiple-choice paragraphs and (7) essay paragraphs. Instructions were attached clarifying the objective and method of answering, and one mark was allocated for objectivity, and the essay marks were distributed according to the answer model, so that the total amount reached (74) marks. The paragraphs were presented to arbitrators and achieved an

agreement rate exceeding 80%, and the necessary amendments were made. The first exploratory application was on (20) female students to determine the clarity of the paragraphs, and the test time was calculated, and the appropriate time was (90 minutes). Then it was applied to the second exploratory sample of (100) female students for the purpose of conducting statistical analysis.

- **Statistical Analysis:** The results showed that the difficulty coefficient ranged between 0.43 and 0.76, and the ease coefficient between 0.24 and 0.57, both of which fall within the acceptable range according to (Maayouf et al. 2017, p. 14). The discrimination coefficient ranged between 0.23 and 0.78, indicating the validity of the test items in distinguishing between students' performance levels, the effectiveness of the wrong alternatives ranged between (-0.296) and (-0.037), and they were all negative, indicating their ability to distract students with low levels.

Psychometric Properties

Validity:

- **Apparent Validity:** Apparent validity was verified by presenting the test items to a group of judges specialized in mathematics and its teaching methods to ensure the correctness of the formulation and scientific accuracy.
- **Construct validity:** The results of the statistical analysis showed a statistically significant correlation at the (0.01) level between each paragraph and its associated skill, with correlation coefficients ranging between (0.373** - 0.988**). It was also found that there was a high correlation between each skill and the total test score, ranging between (**0.808 - **0.989), indicating the consistency of the overall test structure. Furthermore, the paragraphs showed a significant correlation with the total score, ranging between (**0.324 - **0.964), which confirms the internal consistency validity of the test items.

Reliability: The reliability of the Probing Thinking Skills Test was verified using Cronbach's alpha coefficient, with a value of 0.91, indicating that the test has a high degree of reliability (Al-Azami and Jassim, 2018, p. 540). The reliability of the essay paragraphs' marking was also verified in two ways: the first was by re-marking 20 papers after 10 days, with an agreement of 100%. The second was by comparing the researchers' marking with another corrector, with an agreement rate of 97% using Cooper's equation. These values are a good indicator of the test's reliability and validity.

Presentation and Interpretation of Results

To verify the validity of the null hypothesis, the researchers administered a probing thinking skills test to the primary research sample from both groups. The data were analyzed using SPSS (version 23) to extract a statistical description of the scores as in table 4.

Group	Section	Number of Students	Mean	Standard Deviation	SE of the Mean	95% CI Lower Limit	95% CI Upper Limit
Experimental	B	30	52.3667	7.14135	1.30383	6.67260	13.32740
Control	C	30	42.3667	5.64760	1.03111	6.66884	13.33116

Table 4. Statistical analysis of the probing thinking skills of the experimental and control groups

The homogeneity of the two groups was verified using Leven's test and t-test for two independent

samples. The results showed that the experimental group, which studied according to the Renzulli model strategy, outperformed the control group in the test of probing thinking skills.

Group	Number of Students	Levene's Test		t-test		DF	Statistical significance at the level (0.05)
		F	Sig. (p)	T	t-test Sig. (Two-tailed)		
Experimental	30	2.777	0.101	6.016	0.000	58	Statistically significant
Control							

Table 5. Statistical value (F) and (t) for the experimental and control groups in probing thinking skills

Thus, the null hypothesis was rejected and the alternative hypothesis was accepted in favor of the experimental group.

Effect size: The effect was extracted as shown in the table 6.

Independent Variable	Dependent Variable	t-Value	Degrees of Freedom	Eta Squared (η^2)	Effect Size (d)
Proposed Strategy	Probing Thinking Skills	6.601	58	0.384	0.157

Table 6. The extent of the effectiveness of the proposed strategy on the probing thinking skills of the two groups

Interpretation of the results of the probing thinking skills test:

1. The learning environment, using the proposed teaching strategy based on Renzulli's model, provided diverse activities and student engagement, which helped develop higher-order thinking skills, including probing thinking skills.
2. The strategy provided a learning environment based on questioning and discussion, activated self-monitoring and organized thinking, and the analytical tasks contributed to enhancing the students' probing thinking skills.
3. The use of applications such as Desmos and GeoGebra contributes to the activation of probing thinking skills by supporting visual representation, analyzing solutions, and linking concepts within an interactive environment.

Conclusions

- The teaching strategy based on the Renzulli model, supported by the Desmos and GeoGebra programs, contributed to activating the role of students and enhancing their participation, allowing them to practice probing thinking skills through understanding, analysis, and cognitive application.
- The development of skills such as formulating hypotheses reaching conclusion, generalization, and discovering key relationships contributed to raising students' intellectual competence (Jawad, 2022, p. 428).

Recommendations

- A recommendation to the preparation and training departments in the General **Journal of Posthumanism**

Directorates of Education to hold training courses for mathematics teachers on the application of modern strategies, particularly those based on the Renzulli Model, due to their role in developing probing thinking skills and enhancing students' understanding and analysis.

- To the General Directorate of Curricula: Include the proposed strategy in the teacher's guide.

Suggestions

- The effect of a proposed strategy based on the Renzulli Model, supported by Desmos and GeoGebra, on mathematics achievement and intelligent thinking skills among middle school female students.
- The effect of a teaching strategy based on the Renzulli Model, supported by Desmos and GeoGebra, on mathematics achievement and systematic thinking skills among middle school female students.

References

- Abdulaziz, S. (2009). **Teaching thinking and its skills** (1st ed.). Amman: Dar Al-Thaqafa for Publishing and Distribution.
- Abdulaziz, S. (2013). **Teaching thinking and its skills: Exercises and practical applications** (3rd ed.). Amman: Dar Al-Thaqafa for Publishing and Distribution.
- Abu Thabet, I. (2013). **The effectiveness of using GeoGebra software and educational aids in developing mathematical concepts among eighth-grade students** (Unpublished master's thesis). Faculty of Education, State University, Nablus.
- Abu Zaid, N., & Salah, A. (2022). **Socratic thinking: Theory and application** (1st ed.). Amman: Dar Al-Khaleej for Publishing and Distribution.
- Ahmed, K. (2013). **The effectiveness of a proposed interactive computer-based education program in addressing the low achievement of fourth-grade students in mathematics in UNRWA schools** (Unpublished master's thesis). Islamic University, Gaza.
- Al-Ayasrah, W. R. (2011). **Socratic and creative thinking** (1st ed.). Amman: Dar Osama for Publishing and Distribution.
- Al-Ayasrah, W. R. (2015). **Strategies for teaching thinking and its skills** (3rd ed.). Amman: Dar Osama for Publishing and Distribution.
- Al-Kinani, H. K., & Al-Saadi, M. R. A. R. (2023). **The key to integrating technology in teaching: The S.A.M.R. model and school mathematics** (1st ed.). Amman: Dar Al-Ibtikar for Publishing and Distribution.
- Al-Kubaisi, A. W. H. (2015). **Mathematics teaching methods: Approaches, examples, and discussions** (2nd ed.). Amman: Dar Al-I'sar Al-Ilmi for Publishing and Distribution.
- Al-Laqqani, A. H., & Al-Jamal, A. A. (2003). **Dictionary of educational terms defined in curricula and teaching methods** (3rd ed.). Cairo: Alam Al-Kitab.
- Al-Muaiof, R. B., Najad, B., & Hassan, A. (2017). The effect of instructional design based on the understanding-focused teaching strategy on the achievement of fifth scientific grade female students in mathematics. **Journal of Educational and Psychological Research, 14*(54), 1–22.*
- Al-Qamish, M. N. (2011). **Introduction to giftedness and intellectual excellence** (1st ed.). Amman: Dar Al-Maisarah for Publishing and Distribution.

- Al-Quraiti, A. M. (2014). **Gifted and talented individuals: Their characteristics, identification, and care** (2nd ed.). Cairo: Alam Al-Kitab.
- ALRikabi, H. T. (2024). "Information and Communication Technology and its Impact on Improving the Quality of Engineering Education Systems", *International Journal of Engineering Pedagogy (iJEP)*, 14(1), pp. pp. 4–19. doi: 10.3991/ijep.v14i1.46943.
- Al-A'zami, M. A. D., & Jasim, B. M. (2019). The effect of a proposed strategy based on the Adey & Shayer model on pivotal thinking among first-grade female students in mathematics. **Al-Ustadh Journal for Humanities and Social Sciences*, 58*(4), Supplement(1).
- Al-Sufyani, H. M. A. (2021). **General teaching methods** (1st ed.). Yemen: Hadramout University – College of Education – Al-Mahra.
- Al-Yasiri, S. J., Al-Kinani, A. M., & Al-Kinani, H. K. (2013). The guided discovery strategy and its effect on communication skills. **Journal of Educational and Psychological Research*, 10*(36), 269–284.
- B-Majid (2020). "The relationship between conceptual knowledge and procedural knowledge among students of the mathematics department at the faculty of education for pure sciences/IBn Al-Haitham, university of Baghdad", *International Journal of Innovation, Creativity and Change*, 12(4), pp. 333-346.
- Chechan, B., Ampadu, E., & Pears, A. (2023). Effect of using Desmos on high school students' understanding and learning of functions. **Eurasia Journal of Mathematics, Science and Technology Education*, 19*(10), em2331. <https://doi.org/10.29333/ejmste/13540>
- Ghali, H. K. T. H., & Khudhur, A. (2024). The effect of the station rotation model on blended learning in mathematics for third-grade female students. **Journal of Educational and Psychological Research*, 21*(83), 492–503. <https://doi.org/10.52839/0111-000-083-012>
- Guncaga, J., & Majherova, J. (2012). GeoGebra as a motivational tool for teaching and learning in Slovakia. **North American GeoGebra Journal*, 1*(1), 45–48.
- Hassan, A. K. (2023). The effect of a proposed strategy according to the design thinking model in mathematics achievement and personal intelligence among students of sixth class scientific. **International Journal of Emerging Technologies in Learning*, 18*(1), 55–67
- Hammadi, S.S. (2023). "The Effect of Cognitive Modeling in Mathematics Achievement and Creative Intelligence for High School Students", *International Journal of Emerging Technologies in Learning*, 18(9), pp. 203–215.
- Hassan, A. K., & Mohammed, A. S. (2020). The effect of high-order thinking level questions on Socratic thinking skills and mathematical achievement among students of the College of Education for Pure Sciences – Ibn Al-Haytham. **Educational Studies Journal**.
- Hammadi, S. S. (2023). "Impact of Deep Learning Strategy in Mathematics Achievement and Practical Intelligence among High School Students", *International Journal of Emerging Technologies in Learning*, 18(6), pp. 42-52.
- Hohenwarter, M., & Lavicza, Z. (2007). Mathematics teacher development with ICT: Towards an international GeoGebra Institute. **Proceedings of the British Society for Research into Learning Mathematics*, 27*(3), 49–54.
- Issa, A. M. (2018). **School curriculum and gifted education programs** (1st ed.). Amman: Dar Ibn Al-Nafees.
- Jassim, B. M. (2024). "The Impact of Two Proposed Strategies Based on Active Learning on Students' Achievement at the Computer and Their Social Intelligence", *International Journal of Engineering Pedagogy (iJEP)*, 14(1), pp. 39–49. doi: 10.3991/ijep.v14i1.47085

- Jawad, L. F. (2022). Mathematical connection skills and their relationship with productive thinking among secondary school students. **Periodicals of Engineering and Natural Sciences*, 10*(1), 421–430.
- Jawad, L. F., & AlRikabi, H. (2021). “Tactical thinking and its relationship with solving mathematical problems among mathematics department students”, *International Journal of Emerging Technologies in Learning (iJET)*, 16(09), pp.247-262.
- Majeed, B. (2022). “Impact of a proposed strategy according to Luria's model in realistic thinking and achievement in mathematics”. *International Journal of Emerging Technologies in Learning (iJET)*, 17(24), pp. 208–218.
- Mersal, K. M. (2017). Designing enrichment activities based on transformations of effective mathematics using GeoGebra and implementing them in a textbook for preparatory stage students to develop conceptual and procedural mathematical knowledge. **Arab Studies in Education and Psychology Journal**, (81), 147–170.
- Wafaa, A. K., & Jasim, B. M. (2013). The circular house strategy and its effect on the achievement of fifth-grade elementary students in mathematics. **Journal of Educational and Psychological Sciences**, (99).
- Razouqi, R. M., & Mohammed, N. R. (2019). **Thinking and its patterns** (1st ed.). Beirut: Dar Al-Kutub Al-Ilmiyyah.
- Reis, S. M., Fogarty, E. A., Eckert, R. D., & Muller, L. M. (Eds.). (2008). **Schoolwide enrichment model reading framework**. Waco, TX: Prufrock Press.
- Renzulli, J., & Reis, S. (1977). **The Schoolwide Enrichment Model** (Safa Al-A'sar et al., Trans.). Cairo: Dar Al-Fikr Al-Arabi.
- Renzulli, J., & Reis, S. (2015). **The Schoolwide Enrichment Model: A guide to educational excellence** (Rashid Ali Al-Hasnawi, Trans., 1st ed.). Dar Al-Kitab Al-Jami'i.
- Saadah, J. A. (2018). **General teaching methods and their educational applications** (1st ed.). Amman: Dar Al-Mawhiba for Publishing and Distribution, Dar Al-Maisarah.
- Zaytoun, H. H. (2001). **Instructional design: A systemic perspective** (3rd ed.). Cairo, Egypt: Alam Al-Kutub.