



Teaching English language according to the Thinking Hand strategy (Hands-on) and its impact on achievement and probing thinking among fourth-grade scientific female students.

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Abstract:

The current study aims to identify (the effect of teaching English language according to the “Hands-on” strategy on achievement and probing thinking among fourth-year scientific female students). To achieve this, the researcher adopted the experimental method with partial control for two equal groups (experimental and control). The study sample was intentionally selected from female students in the fourth scientific year for the academic year 2024-2025. The sample amounted to (65) female students, distributed randomly (32) female students to the experimental group who studied according to the thinking hand strategy, and (33) female students to the control group who studied according to the traditional method. The researcher conducted a statistical reward process between the two study groups in a number of variables to ensure the accuracy of the results. To collect the necessary data, the researcher prepared two study tools: an achievement test in English language, and a measure of probing thinking. Their validity and reliability were verified, and the necessary psychometric properties were extracted to ensure their suitability for application. After implementing the experiment, which lasted a full semester, the data was collected and statistically analyzed using appropriate statistical methods (T-test for two independent samples). The results showed that the female students of the experimental group who studied according to the thinking hand (Hands-on) strategy outperformed the female students of the control group in both the achievement test and the probing thinking scale, with a statistically significant difference. Accordingly, the researcher concluded the effectiveness of this strategy in deepening linguistic understanding and activating students' investigation and analysis skills. She also recommended the necessity of training teaching staff to employ modern strategies that combine the practical and mental aspects in teaching English language to keep pace with modern educational development.

Keywords: thinking hand (Hands-on) strategy, academic achievement, probing thinking, English language, academic fourth Scientific.



تدريس اللغة الإنجليزية باستخدام استراتيجية "اليد المفكرة" (التطبيق العملي) وأثرها على التحصيل الدراسي والتفكير التحليلي لدى طالبات الصف الرابع العلمي.

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المخلص:

تهدف هذه الدراسة إلى تحديد أثر تدريس اللغة الإنجليزية باستخدام استراتيجية "التطبيق العملي" على التحصيل الدراسي والتفكير التحليلي لدى طالبات الصف الرابع العلمي. ولتحقيق ذلك، اعتمدت الباحثة المنهج التجريبي مع ضبط جزئي لمجموعتين متساويتين (تجريبية وضابطة). تم اختيار عينة الدراسة عمدًا من طالبات الصف الرابع العلمي للعام الدراسي 2024-2025. بلغ عدد العينة 65 طالبة، تم توزيعهن عشوائيًا على النحو التالي: 32 طالبة في المجموعة التجريبية التي درست باستخدام استراتيجية "اليد المفكرة"، و33 طالبة في المجموعة الضابطة التي درست بالطريقة التقليدية. أجرت الباحثة تحليلًا إحصائيًا للمقارنة بين المجموعتين في عدد من المتغيرات لضمان دقة النتائج. لجمع البيانات اللازمة، أعدت الباحثة أداتين للدراسة: اختبار تحصيلي في اللغة الإنجليزية، ومقياس للتفكير التحليلي. تم التحقق من صحة وموثوقية الأداتين، واستخلصت الخصائص السيكومترية اللازمة لضمان ملاءمتهما للتطبيق. بعد تنفيذ التجربة، التي استمرت فصلًا دراسيًا كاملاً، جُمعت البيانات وحُللت إحصائيًا باستخدام الأساليب الإحصائية المناسبة (اختبار T لعينتين مستقلتين). أظهرت النتائج تفوق طالبات المجموعة التجريبية اللاتي درسن وفقًا لاستراتيجية "العمل اليدوي" على طالبات المجموعة الضابطة في كل من الاختبار التحصيلي ومقياس التفكير التحليلي، مع وجود فرق ذي دلالة إحصائية. وبناءً على ذلك، خلصت الباحثة إلى فعالية هذه الاستراتيجية في تعميق الفهم اللغوي وتنشيط مهارات البحث والتحليل لدى الطالبات. كما أوصت بضرورة تدريب أعضاء هيئة التدريس على استخدام استراتيجيات حديثة تجمع بين الجوانب العملية والذهنية في تدريس اللغة الإنجليزية لمواكبة التطورات التعليمية الحديثة.

الكلمات المفتاحية: استراتيجية "العمل اليدوي"، التحصيل الأكاديمي، التفكير التحليلي، اللغة الإنجليزية، الصف الرابع الأكاديمي.

Introduction:

The contemporary world is witnessing radical transformations and tremendous technological and cognitive acceleration, which has forced educational institutions to search for effective ways to keep pace with these changes, as the ability to adapt to new developments has become an essential characteristic of modern humans. Education is no longer just a process of transferring information, but rather has become a strategic investment that seeks to prepare generations capable of understanding the present and anticipating the future in all its educational and technical dimensions, which requires reconsidering the roles of the teacher and the learner and the nature of the



curriculum to be effective tools in achieving sustainable development (Ali and Saleh, 2024: 151).

In this context, academic institutions sensed the need for change, which led to the holding of a series of scientific conferences that called for developing teaching methods, including the Fourth Scientific Conference at the University of Diyala (2002), which called for re-engineering the curriculum and updating it to suit the requirements of the times. The recommendations of the Eleventh Scientific Conference at Al-Mustansiriya University (2005) also focused on the importance of adopting active learning strategies that make the learner the focus of the educational process and develop his personal and leadership skills. These trends stressed the necessity of employing modern teaching approaches to develop students' abilities to face the problems of daily life (Al-Mustansiriya University, 2005: 11).

English language is a tool for global communication and the main key to accessing sources of scientific and technical knowledge in the twenty-first century, which makes teaching it according to modern methodological foundations an urgent educational necessity for ambitious societies seeking leadership. The development in English language curricula is no longer limited to traditional linguistic skills, but has extended to include the development of higher-order thinking patterns and the ability to critically analyze linguistic texts using innovative methods that ensure bridging the knowledge gap between students and their changing world, and give them the ability to interact with other cultures flexibly and competently (Abu Samoura, 2024: 12).

Based on the above, modern educational trends confirm that the thinking hand (Hand_on) strategy works as a bridge between physical participation and mental structure, allowing female students to process linguistic structures through purposeful tactile and motor activities that ensure a deeper understanding of the material active participation through manual tasks significantly enhances memory retention by creating multiple neural pathways during the learning process, enabling fourth-grade scientific students to control their linguistic development in a dynamic and interactive environment that moves away from monotonous stagnation (Thompson, 2022: 84).

Specialists also highlight that using the thinking hand approach reduces the cognitive burden and promotes a more comprehensive classroom environment, where learners can explore the mechanics of language and practice them fluently and with complete confidence. This strategy is particularly effective in secondary education, as it aligns with female students' developmental needs to engage in experiential learning that links theory to



practice, ensuring that female students remain motivated and actively engaged in building their communicative competence (Miller & Scott, 2023: 112).

Moreover, the importance of study highlights the ability of this strategy to provide a stimulating learning environment that helps students move from the stage of simple vocabulary recognition to the stage of complex application in diverse linguistic contexts. Incorporating sensory-rich activities into English language lessons ensures that learners respond better to educational stimuli, which leads to the consolidation of linguistic concepts and their transformation into sustainable skills that serve the student in her future academic and professional life, which is what contemporary educational trends call for (Harrison, 2024: 210).

In parallel with this methodological role, academic achievement remains the ultimate measure for evaluating the success of any educational intervention and the degree to which female students have mastered the prescribed curriculum in English language skillfully and accurately. Modern assessment theories indicate that achievement in a second language does not only include grammatical accuracy, but also extends to the ability to synthesize and apply knowledge in diverse communicative contexts, which is essential for female science students to ensure their successful transition to global academic circles in which English is the primary language of Study (Green & Baker, 2021: 45).

Improving this academic achievement requires adopting educational strategies that enhance deep conceptual understanding rather than superficial recognition of abstract linguistic words and phrases that do not serve the learner in the long term. Study published in the current decade indicates a strong correlation between student-centered learning environments and significant increases in standardized test scores and general language performance, ensuring that achievement reflects true language proficiency and prepares students for the rigors of higher education (Sullivan, 2020: 17).

In addition, outstanding academic achievement is closely linked to the quality of classroom interaction and the ability to retrieve information and use it to solve linguistic and logical problems with high efficiency. Using attractive teaching strategies contributes to building the student's self-confidence, which reflects positively on her final results and her ability to achieve the educational goals desired in the curriculum, and this is what the current Study seeks to confirm by linking manual practice to tangible achievement results (Richardson & Lee, 2023: 59).



On the other hand, probing thinking is a high-level cognitive process that includes a deep investigation of information to reveal basic patterns, reasons, and logical links within the subject matter under study with full awareness. In contemporary education, this mode of thinking is essential for developing critical learners who can evaluate complex texts and engage in sophisticated problem-solving tasks, allowing them to engage deeply with the how and why of linguistic structures and cultural nuances in a scientific manner (Paul & Elder, 2022: 36).

Developing probing thinking skills in English classroom encourages students to question assumptions, seek explanations, and provide evidence-based justifications for their language choices in various educational situations. This analytical approach turns the learner into an active researcher capable of processing information with a high degree of objectivity and accuracy, which is the key to nurturing advanced cognitive abilities and long-term academic success for language learners in light of current cognitive challenges (Linn & Miller, 2023: 412).

Recent studies also indicate that probing thinking does not grow in an environment of indoctrination, but rather requires strategies that push the student to explore the depths of information and search for rich connotations and meanings behind words. Mastering probing skills helps the student organize her thoughts and link new knowledge to her previous experiences, creating an interconnected cognitive structure that contributes to the development of her general linguistic performance and makes her more capable of facing difficult communicative situations with high mental flexibility (Green & Baker, 2021:72).

Methodological integration is clearly demonstrated through the close relationship between practical activity and mental activity, as manual work provides sensory stimuli that require probing thinking to reach a deep understanding of the material. By practicing the activity by hand, the student begins to ask mental questions about the nature of work, which leads her to explore the depths of the material and disassemble it into its primary elements accurately, ensuring that the impact of learning is transferred to actual life situations, which creates an astute thinker who possesses innovative problem-solving skills (Al-Saadi, 2020: 458).

Based on my experience in the field as a researcher and teacher, I see that the real importance of this study lies in its ability to transform the classroom from a place for retrieving information into a laboratory for producing knowledge and developing the mind. The thinking hand strategy represents the ideal solution



for improving academic achievement and developing probing thinking skills among female students, because it addresses their minds and senses at the same time, which makes learning English language a vital and sustainable experience that contributes to preparing a generation of female researchers capable of dealing with the language of modern science with all ability and distinction.

1: Problem of the Study

The problem of the current study is crystallized in the researcher's observation - through her field experience and meeting with a number of English language teachers for the fourth year scientific and specialty supervisors - that there is a tangible decline in the level of academic achievement among female students, accompanied by a clear dominance of the traditional pattern based on memorization and memorization (the traditional method), which deprives the learner of opportunities for deep understanding and the development of higher thinking skills. It has become clear that the large number of female students in one class, and the continuous reliance on dry teaching methods, in addition to the absence of sufficient audio methods and laboratory techniques, has placed additional burdens on the female students to rely on deaf memorization of the material without real understanding or the ability to practice "probing thinking" that requires investigation and Study behind linguistic meanings. Since modern educational Study calls for the necessity of activating the role of the learner through strategies that combine motor performance and mental activity, the Hands-on strategy was chosen as an experimental attempt to demonstrate its effectiveness in addressing these challenges and improving learning outcomes. Accordingly, the Study problem can be defined in the following main question: (What is the impact of teaching English language according to the "Hands-on" strategy on achievement and probing thinking among female students in the fourth year of preparatory scientific?)

2: Importance of Study

The importance of the current study is evident through its keeping pace with modern educational trends that seek to improve the outcomes of the educational process. This importance can be summarized in the following two aspects:

A: The theoretical importance:

- The importance stems from the fundamental value of English language as the language of global communication, and the necessity of using



modern strategies in teaching it, making it a fertile field for educational activities that enable female students to face life situations with high linguistic flexibility.

- The preparatory stage is a critical transitional stage in the cognitive development of female students, which requires providing them with strategies that enhance their self-confidence and develop their higher mental abilities, especially “probing thinking,” which encourages contemplation, contemplation, and examining ideas in depth.
- The scarcity of Study and studies - within the researcher’s knowledge - that have dealt with the Hands-on strategy and its impact on achievement and probing thinking for the preparatory stage in English language, which makes this study a modest contribution to enriching the educational library with a theoretical framework about these modern variables.

2- Practical importance:

- Providing a procedural guide and educational materials (study plans) for English language teachers based on the thinking hand strategy, which contributes to developing their teaching performance and organizing the classroom environment and academic content in an innovative manner.
- Providing specialists and researchers with measurement tools (achievement test, probing thinking test) that have good psychometric properties and can be relied upon as a model in subsequent studies and research.
- Providing practical recommendations and proposals to those in charge of curricula about the effectiveness of integrating strategies that combine motor performance and mental activity, to contribute to addressing the general weakness in the English language subject and moving from memorization to active and sustainable learning.

3: Aim of the Study

The current study aims to identify: (the effect of teaching English language according to the “Hands-on” strategy on achievement and probing thinking among female students in the fourth scientific grade).

4: Hypotheses of the Study :

To achieve the study goal, the researcher developed the following two null hypotheses:



1: There is no statistically significant difference at the level of significance (0.05) between the average scores of the female students of the experimental group (who study English language according to the Hands-on strategy) and the average scores of the female students of the control group (who study in the traditional way) in the post-achievement test.”

2: There is no statistically significant difference at the level of significance (0.05) between the average scores of the female students of the experimental group (who study English language according to the Hands-on strategy) and the average scores of the female students of the control group (who study in the traditional way) in the post-probing thinking test”.

5: Limitations of the study :

The current study is limited to the following :

- Human Frontiers: fourth scientific grade students at Al-Kifah Preparatory School for Girls, affiliated with the General Directorate of Education in Nineveh Governorate. The school was intentionally chosen to implement the study experiment.
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- Spatial boundaries: Al-Kifah Preparatory School for Girls in Mosul City / Nineveh Governorate.
- Time limits: The first semester of the academic year (2024-2025 AD).
- Thematic (methodological) limits: The study topics included in the two units (second and third) of English language book scheduled to be taught for the fourth grade of middle school (English for Iraq), sixth edition (2017 AD, 2nd edition), issued by the Ministry of Education in the Republic of Iraq.

6: Definition of basic Terms:

First: Hands-on Strategy:

- It is defined as: “A method of teaching that relies on a set of scientific and practical activities through which concepts can be discovered in correct ways through manual practice.” (Al-Desouki, 2009: 49).
- Defined as: “a practical experience based on inquiry and collective participation of students through active learning that links movement and mind.” (Sadi, 2011: 90).
- **Procedural definition:** It is a set of procedural steps that the researcher applies in teaching English language, and is based on involving the students of the experimental group in tactile and kinesthetic activities



aimed at transforming abstract rules and vocabulary into concrete models through the stages of (Study and discovery, meaning construction, expansion, and evaluation) to ensure deep understanding under the supervision of the school.

Second: Achievement:

- It is defined as: “The extent to which a student acquires facts, concepts, and principles at a particular stage of study, and is measured by the score he obtains on an achievement test designed for this purpose.” (Al-Salakh, 2013: 26).
- It is defined as: “What learners can actually do after they finish a certain curriculum, and it refers to the knowledge and competence they have acquired as a result of their studies.” (Rivkin, 2010: 34).
- **Procedural definition:** It is the amount of information and linguistic skills acquired by female students in the fourth year of middle school/science (the Study sample) in the two units (the second and third), and it is measured by the final grade that the student obtains in the achievement test prepared by the researcher for this purpose.

Third: Probing Thinking:

- It is defined as: “An advanced mental process that aims to develop the learner’s knowledge so that he is able to generate new ideas and subject them to analysis and trial to reach the most accurate results.” (Al-Ayasrah, 2011: 487).
- It is defined as: “a process of intellectual investigation and deep inquiry aimed at examining assumptions and providing logical justifications to reach a comprehensive understanding of the academic subject.” (Green & Baker, 2021: 72)
- **Procedural definition:** It is a mental activity practiced by a fourth-year middle school/science student aimed at solving linguistic problems. It is measured by the score that the student obtains in the probing thinking test used in the current research.

Previous Studies:

First: Studies that dealt with the Hands-on Strategy:

1. Al-Janabi study (2022): The study aimed to identify the effect of the thinking hand strategy on the achievement of English language and the development of creative thinking among middle school students. It aimed to identify the effectiveness of practical activities in the cognitive and skill aspects



of fourth year middle school students, and it followed the experimental approach on a sample of (62) students who were divided into two groups; An experimental study studied according to the thinking hand strategy and a control study using the usual method. The results showed that there were statistically significant differences at the level of (0.05) in favor of the experimental group in the achievement test and the thinking test, which confirms the effectiveness of transforming abstract linguistic concepts into concrete practices.

2. Miller & Scott Study (2023): The study aimed to identify and measure the effect of learning by doing (the Thinking Hand) in acquiring English language and developing the level of classroom engagement among secondary school students. It adopted an experimental design with two groups, which was applied to a sample of learners in English language. The researchers used a post-achievement test and a note card for performance. The results confirmed the superiority of the “Thinking Hand” group in academic achievement, and attributed this to breaking the stagnation of the lecture and transforming the student into an active element that deals with Information manually and mentally at the same time.

Second: Studies that dealt with probing thinking:

1. Al-Saadi study (2020): The study aimed to identify the effect of active learning strategies on developing probing thinking and academic achievement in English language among fourth-grade female students. It used the quasi-experimental approach and the sample consisted of (60) female students. An achievement test and a probing thinking test were prepared that included skills (comprehension of the concept, interpretation of information, and application of principles). The study found that there was a large and statistically significant effect in favor of the group that was exposed to deep thinking strategies in improving the students’ results and their ability to analyze and understand linguistic texts. Its underlying meanings are highly precise.

2. Green & Baker Study (2021):The study aimed to investigate the effect of teaching based on probing questioning skills on academic achievement in English as a foreign language. It is an experimental study that was applied to a sample of high school students, where the experimental group was subjected to an educational program that relies on the steps of investigation and searching behind meaning. The study proved that the students who learned according to this style showed qualitative superiority in post-achievement tests, and a higher ability to address complex linguistic problems and interpret information in a traditional way compared to the group.



Indicators and implications from previous studies:

1. In terms of purpose: The studies of Al-Janabi (2022) and Miller (2023) agreed in seeking to improve achievement through practical activities, while the studies of Al-Saadi (2020) and Green (2021) focused on deep thinking skills, while the current Study is distinguished by the fact that it combines the “thinking hand” strategy as an independent variable and its impact on “achievement” and “probing thinking” together among fourth-grade science female students.

2. In terms of the tool: The tools varied according to the variables; Local studies used achievement tests and thinking measures prepared by the researchers, while foreign studies relied on linguistic performance tests and observation cards. As for the current study, it adopted (the achievement test and the probing thinking test) prepared by the researcher to ensure their suitability to the Iraqi environment.

3. In terms of sample: The samples ranged between (60 to 62) individuals, and included the middle and high school levels, which is consistent with the current Study sample, which was represented by female students in the fourth middle school (scientific) year, numbering (60) students, distributed into two groups (experimental and control) to ensure comparative statistical control.

Study methodology and procedures:

First - Experimental Design: The researcher adopted the experimental method with partial control, which is a design that includes two groups (experimental and control) with a post-test for both (achievement and probing thinking); This is due to its suitability to the conditions of the current experiment and its high ability to control extraneous variables in the school environment, and to determine the effect resulting from the independent variable (the thinking hand strategy) on the dependent variables.

The experimental design followed can be explained in the following table:

Figure (1)

Experimental design

no	Groups	Independent Variable	Post-test
1	Experimental	Hand-on strategy	Achievement test and probing thinking



2	Control	Traditional Method	
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Second: Study Population and Sample:

The current Study population is represented by all female students in the fourth grade of preparatory school (scientific branch) in the middle and secondary day schools affiliated with the General Directorate of Education of Nineveh for the academic year (2024-2025 AD). The researcher intentionally chose (Al-Kifah Preparatory School for Girls) to implement the experiment, where two groups were randomly drawn, namely (A and B), with a total number of (70) students, and with a simple random assignment method, group (B) was represented as an “experimental group” taught according to the hand strategy. Notebook, and Section (A) as a “control group” taught in the usual way, with (35) students for each group; The researcher statistically excluded the failing female students (3 female students from the experimental group, and two female students from the control group) to ensure the equality of the sample and avoid the effect of their previous cognitive experience, so that the final number of the Study sample became (65) female students, with (32) female students for the experimental group and (33) female students for the control group.

Third: Equivalence of the two Study groups:

To ensure the integrity of the experiment and attribute the results to the independent variable, the researcher conducted statistical equivalence between the two Study groups (experimental and control) in a number of extraneous variables. The statistical treatment showed the following results:

1. Chronological age (in months): It was found that there was no statistically significant difference; The calculated T-value was (0.536), which is less than the tabulated value (2,000) at the level of (0.05) and the degree of freedom (63).

2. Intelligence: Statistical treatment showed female students’ homogeneity in their mental abilities. The calculated T-value was (0.784), which is not statistically significant.

3. Previous achievement in English language: The researcher adopted the previous year’s grades (2023-2024), and the results showed that there were no statistically significant differences, as the calculated T-value was (0.451), which is less than the tabulated, which confirms the equality of previous language experience.



4. The general average for the previous year: The calculated T-value was (0.698), which indicates that they were equal in their general academic level before the start of the experiment.

5. Parents' educational level: Using the Chi-square test (X^2), it was found that there were no statistically significant differences; The calculated value of education for fathers was (1,542) and for mothers (1,843), which is less than the tabulated value (5,99), which confirms the equality of cultural and environmental background.

Thus, statistical control was achieved for the two groups, allowing any difference in subsequent results to be attributed to the effect of the independent variable (the thinking hand strategy).

Fourth: Study Procedures :

The researcher began her procedures by selecting the scientific material from English language textbook (English for Iraq) for the academic year (2024-2025), limiting it to the second and third units to be the applied field for the experiment. Then she moved on to formulating (92) behavioral objectives that covered the first five "Bloom" levels after presenting them to the experts to ensure their scientific integrity and standard ability.

In light of these objectives, the researcher prepared (18) teaching plans that were distributed equally between the experimental and control groups. The experimental group adopted the steps of the Thinking Hand strategy and the control group adopted the usual method. This was reinforced by the construction of an accurate specifications table that ensures the comprehensiveness and balance of the achievement test, which resulted in the selection of (30) multiple-choice test items distributed according to the relative weights of the content and objectives.

Fifth - Study Instruments:

The current Study requires the preparation of two tools to verify the effect of the independent variable on the dependent variables, which are English language achievement test and the probing thinking test. The following is a description of the procedures for preparing each of them:

The researcher built an achievement test in English language that included the two units (second and third) for the fourth year of middle school for the academic year (2024-2025) to measure cognitive levels (remembering, comprehension, application, analysis, synthesis, and evaluation). The researcher



identified the scientific material and derived (30) test items of the multiple-choice type with four alternatives based on a table of specifications (test map) that ensures the distribution of questions according to the relative importance of the content and behavioral objectives; To ensure the accuracy of the tool, the researcher developed clear instructions for the answer and a correction system that gives one mark for the correct answer and zero for the wrong answer. She also verified the “face validity” and “content validity” by presenting the test to the experts and conforming it to the specifications table. Then, it was applied in a survey on (100) female students from the fifth year of preparatory school at Mosul Preparatory School for Girls, where the average response time of (40) minutes was extracted; Analyzing the results statistically, it was found that the difficulty coefficient ranged between (0.25-0.72) and the discriminatory power ranged between (0.32-0.75), with clear effectiveness for the incorrect alternatives. Reliability was also calculated using the (Cuder-Richardson 20) equation and amounted to (0,80), so that the test in its final form consisting of (30) items is ready to be applied to the two Study groups.

The researcher also prepared the probing thinking test as a second tool for the current Study by reviewing previous literature and identifying its three strategies, which are (comprehension of the concept, interpretation of the concept, and application of the concept), in light of which she formulated (34) items in their initial form that include linguistic situations and problems that measure the students’ investigative skills. To verify the efficiency of the tool, the researcher relied on “apparent validity” by presenting the test to a committee of experts in measurement, evaluation, and methods of teaching English language, and the items received an approval rate of (85%) or more with the procedure Some suggested linguistic modifications and the formulation of clear instructions that accurately explain how to answer, then I applied the test exploratory to a sample of (100) female students in the fourth year of middle school at Al-Zuhur Preparatory School for Girls on (11/12/2024) to calculate the average answer time, which amounted to (35) minutes. By conducting statistical analysis of the items by arranging the answers in descending order and choosing a percentage of (27%) for the upper and lower groups, the difficulty factor was extracted, which was found to fall within the educationally acceptable range. The discriminatory power of the items ranged between (0.34-0.62), which confirmed their high ability to differentiate between the levels of female students. The results of the effectiveness of the false alternatives showed that all values were negative, which means they attracted the female students in the lower group. Based on these results and the reassuring psychometric properties, it was concluded that The researcher tested all (34) test items, and the reliability was verified on (11/13/2024) on a sample of (30) female students using the (Cuder-Richardson 20) equation, where its value reached (0.88), which is a high



and acceptable reliability value that makes the test ready for final application to the two Study groups.

Sixth: Experimental Implementation

The researcher began implementing the experiment in the field in the first semester of the academic year (2024-2025), where she began her procedures by applying the probing thinking test for the purpose of equivalence on Tuesday, corresponding to (11/12/2024), and then began the actual teaching from Wednesday, corresponding to (11/15/2024) until Sunday, corresponding to (1/26/2025), with five classes per week for each of the experimental group that studied according to the strategy The thinking hand and the control hand that taught in the usual way, and after completing the teaching of the prescribed units, the researcher applied the post-probing thinking test on Monday, corresponding to (1/20/2025), followed by applying the achievement test on Thursday, corresponding to (1/23/2025) in cooperation with the subject school and after informing the students of its date a week before, and then the researcher corrected the answers and monitored the final grades for the two groups in preparation for treating them statistically.

Seventh: Statistical Methods:

To achieve the Study goals and process the extracted data, the researcher used the Statistical Portfolio for the Social Sciences (SPSS), in addition to the following statistical methods: (Chi-square, item discrimination coefficient, Corder-Richarson equation 20, t-test for two independent samples (t-test)).

Presentation and Discussion of Results:

- Results related to the first null hypothesis: It states that “there is no statistically significant difference at the significance level (0.05) between the average scores of the female students of the experimental group (who are studying English language according to the Hands-on strategy) and the average scores of the female students of the control group (who are studying in the usual way) in the post-achievement test.” To verify this hypothesis, the researcher extracted the arithmetic mean and standard deviation of the achievement test scores (consisting of 30 items) for the two Study groups, and applied the t-test for two independent samples, and Table (1) shows this:

Table (1)



T-test results for the arithmetic mean and standard deviation for the two groups in the achievement test

Groups	no	Arithmetic Average	Standard Deviation	T-test		Level of Significance
				calculated	Tabular	
Experimental	32	23,584	3,547	6,003	2,000	significance at (0.05) and degree of freedom (63)
Control	33	17,651	4,365			

Observing the previous table, we find that the calculated (t) value was (6,003), which is greater than the tabulated value of (2,000) at a significance level of (0.05) and a degree of freedom (63), which indicates the presence of a statistically significant difference in favor of the experimental group; Accordingly, the first null hypothesis is rejected and the alternative is accepted.

The researcher attributes the superiority of the experimental group in the achievement test essentially to the nature of the mental and motor interaction provided by the Hands-on strategy. Involving the students in concrete linguistic activities gave them a safe space to express their ideas and discuss the complex linguistic structures of the two units (the second and third) away from traditional stagnation, which contributed to transforming knowledge from mere theoretical rules and vocabulary that the student received passively to live experiences that were circulated and formulated in a subjective manner, which led to organizing the cognitive structure and linking the new information to previous acquisitions in a logical manner. The process of “learning by doing” made the students use their manual and mental skills together to represent linguistic situations, which created a common, simplified language (peer language) that was closer and clearer to the learner than the language of the textbook, which reflected positively on the accuracy of their comprehension and their excellence in the thirty test items.

Moreover, the thinking hand strategy enhanced the students’ “metacognition” skills through continuous monitoring of the understanding process while implementing activities. When the student practices the steps (research, discovery, and constructing meaning), she practices an immediate mental review of what she has learned, which allows her to discover gaps in understanding the



rules and address them immediately. The immediate feedback provided by practicing the activity reduces the accumulation of misconceptions that usually hinder achievement in English language. The feeling of material accomplishment (the educational product) motivated the students to persevere and focus, which created an internal motivation towards learning that far exceeds what is provided by the usual method based on indoctrination. These explanations are consistent with the theoretical framework of the strategy, which confirms that learning is more stable and sustainable when the learner participates in its production, which was confirmed by the study (Al-Janabi, 2022) and the study (Miller & Scott, 2023) in their educational feasibility.

- Results related to the second null hypothesis: It states that “there is no statistically significant difference at the level of significance (0.05) between the average scores of the female students of the experimental group (who study English language according to the Hands-on strategy) and the average scores of the female students of the control group (who study in the usual way) in the post-probing thinking test.” To verify this hypothesis, the researcher extracted the arithmetic mean and standard deviation of the scores of the probing thinking test (consisting of 34 items) for the two Study groups, and Table (2) shows this:

Table (2))T-test results for the average scores and standard deviation of the two groups in the probing thinking test

Groups	no	Arithmetic Average	Standard Deviation	T-test		Level of Significance
				calculated	Tabular	
Experimental	32	28,478	4,461	4,429	2,000	significance at (0.05) and degree of freedom (63)
Control	33	22,987	5,735			

Observing the previous table, we find that the calculated (t) value was (4,429), which is greater than the tabulated value (2,000) at a significance level of (0.05) and a degree of freedom (63), which indicates the presence of a statistically significant difference in favor of the experimental group; Accordingly, the second null hypothesis is rejected and the alternative is accepted.



The researcher attributes the noticeable improvement in the probing thinking skills of the female students in the experimental group to the great harmony between the steps of the Hands-on strategy and the probing thinking skills. During the stages of investigation and research, the practical activity helped the students understand linguistic structures from multiple points of view, which enabled them to penetrate the essence of meaning with greater accuracy than what the students achieve in the usual method. The transition to the stage of “constructing meaning” and interpreting it was like a mental and motor investigation session, as the strategy gave each student the freedom to ask probing questions and discuss the logic of the answers with her classmates, which enhanced their flexibility of thinking and the ability to see various alternatives for interpreting linguistic texts, thus transforming English language from mere dry words into intellectual challenges that require building “investigative models,” testing, and self-evaluating them before adopting them.

Moreover, the thinking hand strategy provided an effective and regular mechanism for the feedback process; Through mutual constructive criticism while implementing activities, each student is able to see the strengths and weaknesses in her way of thinking based on the tangible results she reaches. This style of active learning contributed to refining analytical and critical thinking skills, which are the backbone of probing thinking. The students’ sense of responsibility towards the knowledge they discovered on their own increased their confidence in their mental abilities, which encouraged them to undertake the more complex linguistic tasks in the probing thinking test. This vision is consistent with the theoretical framework that emphasizes that probing thinking is a mental activity that develops through dialogue and experimental work, which was supported by the results of the study (Mansour, 2023) and the study (Smith & Brown, 2022) in their confirmation that the interactive educational environment is the primary driver of depth of thinking and development of linguistic skills.

· Conclusions:

In light of the results of the current research, the researcher concluded the following:

1: Using the thinking hand strategy (Hands-on) proved highly effective in raising the level of academic achievement in English language among fourth-year middle school female students compared to the usual method, which indicates that the combination of motor and mental activity contributes to consolidating information and retaining it for a longer period.



2: The Thinking Hand strategy clearly contributed to developing the students' probing thinking skills, as the strategy provided an interactive environment that allowed for practicing investigative skills, generating hypotheses, and reaching deep meanings, which are skills that are difficult to develop through direct indoctrination.

3: The learning system based on "work and research" broke the barrier of fear and anxiety regarding the rules of English language, transforming it from a dry subject into a stimulating social and mental activity, and this reflected positively on the students' motivation and confidence in their linguistic abilities.

4: The Study has proven that middle school female students have a high willingness to interact with active learning strategies based on dialogue and exploration, and that integrating these strategies with modern thinking skills (such as probing thinking) leads to qualitative educational results that go beyond mere memorization to deep understanding.

5: Pre-planning English language lessons according to the steps of the Thinking Hand strategy helped address individual differences among students, as the immediate feedback resulting from the implementation of activities provided an opportunity to correct each student's cognitive path according to her own pace of learning.

·Recommendations:

Based on the positive results that demonstrated the effectiveness of the Thinking Hand strategy in raising the level of achievement and probing thinking skills, the researcher recommends the following:

1: Adopting the thinking hand strategy as a main teaching model in English language classes for the preparatory stage, to transform the student from a passive recipient into an active participant who builds knowledge linguistically and practically.

2: Directing English language teachers towards formulating educational situations and investigative questions that develop probing thinking skills, which gives students a greater ability to analyze texts and understand deep meanings.

3: Holding specialized training workshops for teaching staff to train them on mechanisms for integrating motor activities (Hands-on) into teaching grammar and vocabulary, and how to manage active classroom interaction.



4: Developing methodological guides to include enrichment activities based on exploration and research, and creating a stimulating classroom environment that reduces anxiety about language and enhances the student's confidence in her linguistic abilities.

·Proposals:

To complement the results of the current Study and in light of what was revealed about the effectiveness of the Hands-on strategy, the researcher proposes to conduct the following studies and research:

- 1: The effect of the thinking hand strategy on developing deductive thinking and linguistic fluency among middle school students in English language.
- 2: The effectiveness of a training program based on probing thinking skills on the teaching performance of male and female English language teachers and its impact on the achievement of their students.
- 3: A comparative study between the thinking hand strategy and the flipped learning strategy in developing reading comprehension skills among female secondary school students.
- 4: The effect of combining the thinking hand strategy with multimedia in developing linguistic intelligence and attitude toward the subject among primary school students.

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