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Research Article

The Effect of the Perkins &Blythe Model on The Systematic Thinking Skills of Second-Intermediate Students in Mathematics

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Abstract

The aim of the current research is to identify the effect of using the Perkins & Blythe model on the systematic thinking skills of second-grade students in intermediate school in mathematics. The research sample consisted of (56) students of the second intermediate grade, for the first semester of the academic year (2020-2021), the (Al-Adala Secondary School for Boys) affiliated to the Diyala Education Directorate / Baquba District was chosen intentionally, and by random selection, group (A) was chosen.

To represent the experimental group that was taught according to the Perkins & Blythe model, with (28) students, and group (B) to represent the control group that studied according to the usual method with (28) students, and the two groups were rewarded in the following variables (intelligence, educational level of the parents, chronological age, previous information in mathematics, and previous achievement in mathematics).

The research tool was prepared, which is: a systemic thinking skills test consisting of (16) essay paragraphs, and the validity of the test was confirmed. And by using the Alpha-Cronbach equation, the stability of the test items was (0.73). After completing the experiment, the test was applied to the two research groups, and after collecting data and using appropriate statistical methods, the results of the research were as follows:

There is a statistically significant difference between the experimental and control groups in the systemic thinking skills test, in favor of the experimental group. In light of the results of the research, the two researchers recommended that the Directorate of Preparation and Training in the General Directorate of Education of Diyala conduct training courses on the use of modern models and strategies in teaching, including the Perkins & Blythe model to increase the understanding process of learners, and suggest conducting a study to determine the extent to which teachers possess the skills of systemic thinking for the different academic levels.

Research'sProblem:

The more the learners progress during their studies in the different grades, the more the curricula depend heavily on the comprehension skills they possess, and if these problems are not addressed, this will negatively affect the progress of the learning process for learners in most areas of knowledge in general and education in particular (Abu Shaaban, 2010: 38). .

This was confirmed by the study (Al-Zubaidi, 2011) of a weakness in the systematic thinking skills of second-grade students in mathematics, which negatively affects their understanding and comprehension, which should focus on the need to use models that improve the understanding process of students.

Therefore, there was a need to use some models that depend on understanding, including the (Perkins & Blyth) model by experimenting with it in teaching mathematics for the second intermediate grade as modern teaching models that hope to have a positive impact in raising the level of students' achievement in thinking skills. System they have based on the foregoing, the problem of the current research can be determined by answering the following question:

-What is the effect of the (Perkins & Blythe) model on the systematic thinking skills of second-intermediate students in mathematics?

Research's Importance:

1- The current research derives its importance in demonstrating the impact of the Perkins & Blythe model on systemic thinking skills.

2- The Perkins & Blythe model is considered one of the modern and effective models, if it is successfully applied in all educational levels, especially the middle school. It improves students' comprehension.

3- Develop students' ability to think systemically by using systematic steps when dealing with any mathematical problem and trying to find appropriate solutions to it.

4- The current research provides a test of systemic thinking, which may benefit researchers in conducting research in this field.

Research'sGoal:

The current research aims to know the effect of using the Perkins & Blythe model on the systematic thinking skills of second-grade students in mathematics.

Research'sHypothesis:

To verify the objective of the research, the following null hypothesis was formulated:

There is no statistically significant difference at the significance level (0.05) between the mean scores of the experimental group students who will study the subject according to the Perkins & Blythe model and the scores of the control group students who will study the same subject according to the usual method in the systematic thinking skills test.

Limitations of the search:

The search is limited to:

1- Students of the second intermediate grade in middle and secondary day schools for boys affiliated to the General Directorate of Education in Diyala Governorate.

2- The content of three chapters of the mathematics textbook to be taught to students of the second intermediate grade, part 1, i 3, 2019, which are (Chapter Two: Real Numbers, Chapter Three: Frontiers, Chapter Four: Equations and Inequalities).

3- Systemic thinking skills (the skill of analyzing the main system into sub-systems, the comprehensive vision of the system, realizing the relationship within the system, and restructuring the system from its components)

4- The first semester of the academic year 2020/2021.

Definition of Terms:

1- The model was defined by: (Al-Adwan et al., 2011) as: "a schematic representation in which processes, events and procedures reside in a logical manner capable of being understood and interpreted" (Al-Adwan et al., 2011: 163).

2- Perkins & Blythe model: It was defined by (Perkins & Blythe, 1994) as: "a model that provides learners with opportunities to do activities and actions that require thinking about certain topics, and carrying out several operations such as: giving proofs and examples, clarification, and expressing the topic in new ways" (Perkin & Blythe, 1994:5) .

Procedural definition: It is a four-stage (learning for understanding) teaching model that the researcher uses to teach second-grade intermediate students, which begins with introducing the material that is relevant to their lives and reaching distinctive characteristics through their understanding of the scientific material, then the participation of students in the implementation of a set of educational tasks, and finally giving students the opportunity to modify and deepen the concept through continuous evaluation of them.

3. Systemic thinking: he defined it (Al-Menoufi, 2002) as: "a set of skills through which the main systems are analyzed into sub-systems and the system is restructured from its components and the realization of the relationships within the single system, and between the system and other systems, and then a comprehensive view of any subject without It loses its parts" (Al-Munoufi, 2002: 47).

Theoretical Procedural definition: a system of mental operations through which students of the second intermediate grade can form a comprehensive view of the mathematical subject to be learned, synthesize and analyze its knowledge through its relations with other systems and then seek to bridge the gaps and then analyze it into parts and realize the relationships that link these parts And re-install it so that the system is more clear to the students, and it is inferred by answering the paragraphs of the systemic thinking skills test prepared for the purposes of the current research.

Theoretical framework and previous studies:

The first axis: the theoretical framework

-Perkins & Blythe Model (learning to understand)

It has been assumed (Perkins & Blythe, 1994) that it is not possible to understand everything about a particular topic because there are a large number of relationships and applications that require the learner to discover them, so the understanding must be re-understood more than once until the knowledge is built and expanded in the end, meaning that the indicator The main inferring of understanding is the dependence of knowledge beyond the context and content in which the learning was originally taken to other situations and uses (Perkins & Blythe, 1994: 5).

The original framework of the Perkins & Blythe model (learning to understand) consists of four basic stages, and these stages (elements) help focus teachers' energy and time to help their students understand a particular topic or lesson, and a fifth stage was added to this model after a few years From the proposal of the model for the first time when researchers began to take into account the integration of technology (Wiske & Franz) and this stage is (reflective cooperatives) (Moisey, 2010:5).

The basic stages of the Perkins & Blythe model (learning to understand):

1- Generative or generative topics: Presenting scientific material, which is relevant to the learners' daily life and the local environment.

2- Comprehension objectives: determining the learners' understanding of the educational material presented, and arriving at distinctive characteristics.

3- Performance that shows comprehension (measurement of comprehension of comprehension): that is, involving learners in completing educational tasks to know the extent of their understanding of the scientific material.

4- Continuous evaluation: providing opportunities for learners to modify and deepen the scientific concepts agreed upon among the scholars and crystallize them.

(Perkins & Blythe 1994: 39-45)

-**Systemic Thinking:**

Systemic thinking is an appropriate way to address contemporary educational problems through a holistic view of the educational system with all its components and analysis of its problems in the light of the interrelationships between those components, and in light of the continuous need to improve performance that must be compatible with this rapid change, the need to apply systemic thinking in the field of Solving complex problems as a new vision through which it solves many problems in a deeper, more objective and comprehensive manner (Ismail, 2011: 2).

-Systemic Thinking Skills:

Systemic thinking skills are nowadays a particularly urgent need, and the development of these skills is faced with a question: How can individuals become smarter? Because when the individual deals with the natural world, he collects the relevant evidence, classifies, interprets and tests it, in order to reach an understanding of knowledge and its application in practical life, which makes him more active, as the acquired knowledge forms a strong basis for new learning, and hence the learners or individuals need to Learn systems thinking skills, as a tool that helps them to live and deal in a fast and increasingly complex world (Mustafa, 2011: 21). There are several classifications of systems thinking skills, including:

Table (1)

Classification of systemic thinking skills according to each study

Skills classification	The name of the study
1- Analyzing the main systems into sub-systems 2- Re-installing the system from its components 3- Awareness of the relationships within the same system, and between the system and other systems. 4- A comprehensive view of any topic without losing its parts (Al-Menoufy, 2002: 476).	(Al-Menoufy, 2002)
1- The skill of reading the systemic form 2- The skill of analyzing the shape and realizing the relationships 3- The skill of completing relationships in the figure 4- The skill of drawing a systematic figure (Asqoul and Hassan, 2007: 12)	(Asqoul and Hassan, 2007)
1- The skill of analyzing the system 2- The skill of the comprehensive vision of the system 3- The skill of perceiving systemic relationships 4 The skill of installing the system (Abu Odeh, 2006:52)	Abu Odeh, (2006)
1- Closed-loop thinking: i.e. analysis of a situation or system 2- Holistic thinking: that is, the comprehensive vision of the system 3- Practical thinking: the individual's ability to see how the parts affect each other 4- Structural thinking: that is, restructuring the system from its parts. 5- Dynamic thinking: The skill of practicing forms of thinking includes: the ability to see and infer behavior more than just focusing on predicting events. 6- Scientific thinking: It includes common scientific thinking skills. 7. Connected thinking (Richmon, 1993: p122-131)	(Richmon, 1993)

The classification of (Al-Menoufy, 2006: 2002) systemic thinking skills was relied upon.

The second axis: previous studies:

Table(2)

Results	Dependent variable	Independent variable	Statist-ical means	Study tools	Sam-ple size and gend-er	Study Procedur-e	Study stage	Study objective	Name of Study, year and location	**Seq.**
* There is a significant difference Statistically between the experimental and control groups in the concept acquisition test * There is a statistically significant difference in concept retention	Acquisition of scientific concepts	Perkins and Blythe model	t-test for two independent samples	Concept acquisition test	(70) stud-ents	experimental	the first secondary	The impact of an educational model that emphas-izes understanding in the acquisi-tion of concepts by first-year second-ary students in biology and their retention in it	(Ahmed, 2013) Jordan:	1
There is a statistically significant difference between the averages of the two research groups in the achievement tests and systemic thinking skills in favor of the experimental group	academic achievement -System-atic thinking skills	treated with the prop-osed inte-grat-ive unit	t-test for two independent samples	Academic achievement - Systematic think-ing skills	(41) male and fem-ale stud-ents	the descriptive appro-ach in an analyt-ical method and the semi-descriptive appro-ach	Fourth level / science and mathematics teacher in the College of Education	Identify-ing the effective-eness of an integrated educat-ional unit in the energy course in develop-ing academic achievement and systemic thinking skills among fourth-level students enrolled in the Science and Mathematics Teacher Program at the College of Educa-tion - Ibb Univer-sity.	(Al-Haddad, 2018)	

Research Methodology and Procedures:
The experimental method was followed, as it is the appropriate method to achieve the goal of the current research and its hypotheses.
First: Experimental Design: A quasi-experimental design with partial control was chosen for two groups, one experimental and the other control, as shown in Table (3).

Table (3)
Experimental design approved in the research

Tools' research	dependent variable	independent variable	equivalence of the two groups	Group
Systematic thinking skills test	- Systematic thinking skills	Perkins & Blythe model	- intelligence - The educational level of the parents -Chronological age in months -Previous information in mathematics Previous achievement in mathematics	Experimental
		The usual way		Control

Second: The research community and its sample: The research community was identified with students of the second intermediate grade in the government middle and secondary day schools of the General Directorate of Education in Diyala Governorate - Baquba / for the academic year (2020-2021) and a secondary school (Justice for Boys) was intentionally chosen to apply the research experience.
Third: Control procedures: Internal safety and equivalence between the two groups were conducted in some variables that have an impact on the dependent variable (intelligence, parents' educational level, chronological age calculated in months, previous information in mathematics, and previous achievement in mathematics), and the following is an explanation For statistical equivalence operations for these variables:

Table (4)
The x^2 value of the difference in the intelligence percentiles of the students of the experimental and experimental groups

Statistical Sig. among the level (0.05)	value χ^2		Total	Level of Intelligence			section	Group
	Tabu-lar	Calcu-lated		Good %95-%75	Medium %75-%25	Mediocre %25-%5		
Non-Sig.	5.99	0.91	28	10	12	6	A	Experi-mental
			28	11	11	6	B	Control
			56	21	23	12	Total	

Table(5)
Results of values (x^2) to find out the significance of the difference between the two research groups in the educational level of the parents

Statistical Sig. among the level (0.05)	χ^2		Total	Achievement level			Variable	section	Group
	tabular	calculated		institute and above	Preparatory	Intermediate or less			

Non-Sig.	5.99	0.290	28	9	7	12	Father's academic achievement	A	Experimental
			28	8	6	14		B	**Control**
		2.040	28	6	9	13	Mother's academic achievement	A	Experimental
			28	5	5	18		B	**Control**

Table(6)

Statistical description of the two research sample groups in the variables (chronological age and previous information in mathematics and previous achievement in mathematics)

Standard error of the arithmetic mean	Standard deviation	Arithmetic mean	Sample number	Variable	section	Group
1.051	5.56	162.71	28	Chronological age in months	A	Experimental
1.009	5.34	161.82	28		B	Control
0.43	2.28	9.89	28	Previous information	A	Experimental
0.38	1.99	9.89	28		B	Control
2.18	11.51	61.46	28	Previous achievement	A	Experimental
1.97	10.44	58.04	28		B	Control

Table (7)

Congruence test to check the equivalence between the two research groups (experimental and control) according to the variance in the variable (chronological age, previous information and previous achievement)

Statistical Sig. among the level (0.05)	valuet-test		degree of freedom	Levenes' test For the two variances to be equal		Variable
	tabular	calculated		It's achievment	value F	
Not significant	2	0.613	54	0.930	0.008	Chronological age in months
		0		0.545	0.371	Previous information
		1.167		0.251	1.345	Previous achievement

B. The external safety of the experimental design: Some variables believed to affect the experiment were controlled, and these variables are:

- Duration of the experiment: The duration of the experiment application is equal for the two research groups, which is the first semester of the academic year (2020-2021), where the experiment began on Sunday (13/12/2020) and ended on Sunday (14/2/2021).

- Scientific material: The same scientific period was presented for the two groups (experimental and control).
- Associated Accidents: The experiment was not exposed to accidents or to emergency conditions that impede its functioning.
- Experimental extinction: No cases of dropping out or dropping out of school were recorded, except for almost equal minor absences for both groups.
- Distribution of teaching classes: To ensure parity, the two groups (experimental and control) were taught according to the schedule prepared by the school administration, as the number of lessons was (5) per week (1 day in person and 4 days electronically) for each of the two groups.

Fourth: Research Requirements:

1- Determining the scientific subject: The scientific subject was determined according to the curriculum content from the mathematics book for the second intermediate grade for the classes to be taught during the first semester of the academic year 2020-2021 (Chapter Two: Real Numbers, Chapter Three: Frontiers, Chapter Four: Equations and Inequalities).

2- Formulation of behavioral objectives: Behavioral objectives were formulated according to Merrill's classification of behavioral objectives, which include three levels (remember, application, discovery) and were presented to a group of arbitrators in mathematics teaching methods Annex (2) to indicate their views on its formulation and the extent to which it achieves teaching objectives The three chapters, and an agreement of 80% or more was adopted, and some behavioral purposes were modified according to this percentage.

3. Preparation of Teaching Plans: A set of teaching plans were prepared for each of the two research groups, totaling (40) daily plans. A sample of them was presented to a group of arbitrators in the methods of teaching mathematics to benefit from their opinions and observations about their suitability for the educational content, and some modifications were made to reach its final form.

Fifth: The search tool:

Preparing the Systematic Thinking Skills Test: The Systematic Thinking Skills Test was prepared for the second intermediate grade students as follows:

1- Determining the objective of the test: The test aims to measure the systemic thinking skills of second-grade students in order to know the effect of the independent variable in them.

2- Preparation of test items: The two researchers reviewed the literature and studies that were conducted in order to measure the skills of systemic thinking, such as the study (Al-Menoufi, 2002), the study (Abu Odeh, 2007), the study (Al-Khazraji, 2013) and the study (Al-Zubaidi, 2011), and based on the opinions of experts and arbitrators in Methods of teaching mathematics, and then systemic thinking skills were determined based on a classification (Al-Menoufi, 2002), which includes four skills: (the skill of analyzing the main systems into sub-systems, the skill of comprehensive vision of the subject, the skill of realizing relationships within the system, and the skill of restructuring the system from its components), which The test measures it for second-grade intermediate students to match the characteristics of second-grade intermediate students and their mental abilities.

Table(8)

Distribution of the systemic thinking test items on the four skills

Total	Paragraph numbers	Type of skill	**Seq.**
4	**1,2,3,4**	Decomposition of the main system into subsystems	**1**
4	**5,6,7,8**	Overall view of the topic	**2**
4	**9,10,11,12**	Realizing the relationship within the same system	**3**
4	**13,14,15,16**	Re-installing the system from its components	**4**
16	Total		

Execution of the experiment: The experiment was applied in the first semester (course) of the academic year (2020-2021), as it started on Sunday (12/13/2020) and ended on Sunday (2/14/2021), and procedures were carried out. The equivalence between the two research groups, where the prior knowledge test was applied on Sunday (12/12/2020), and the intelligence test on Monday (14/12/2021), the systemic thinking test was applied on Monday (2/8/2021) and the students were informed of the test date one week before it was scheduled to take place.

Statistical means: The appropriate statistical methods were used in data processing, using the statistical program spss 23 to obtain the results

Presentation and Interpretation of Results:

First, show the results:

The results of the null hypothesis: It states that: (There is no statistically significant difference at the significance level (0.05) between the mean scores of the experimental group students who studied the material according to the (Perkins & Blythe) model and the scores of the control group students who studied the same subject according to the usual method in the test Systemic thinking skills. After applying the systemic thinking skills test and correcting the answers, the results shown in Table (9) appeared.

Table (9)
The value of (F) and (t) for the two research groups (experimental and control) in the variable of systemic thinking skills

Statistical Sig. among the level (0.05)	Value- t		Levenes' test For the two variances to be equal		Standard error of the arithmetic mean	Standard deviation	Arithmetic mean	Number of Students	section	Group
	tabular	Calcul -ated	Sig.	F value						
Sig.	2	6.928	0.122	2.466	1.443	7.637	69.21	28	A	experimental
					1.239	6.557	56.04	28	B	control

Second: Interpretation of the results:
1 That the (Perkins & Blythe) model consists of sequential steps, where the subject was presented in the form of problems that require thinking on the part of the student with the help of the teacher, which helped in orderly thinking and following sequential steps in understanding the subject.
2- The (Perkins & Blythe) model is one of the educational models that emphasize understanding, which helps learners to develop higher-order thinking skills, and this in turn helps to develop their systemic thinking skills.
3- The Perkins & Blythe model gives the student an important role in the teaching-learning process by increasing the participation of students in linking new experiences with previous experiences related to the topic of the lesson and thus enhancing the understanding process.
Third: Conclusions: According to the results of the current research, the two researchers reached the following conclusions:
1- Teaching students according to the steps of the Perkins & Blythe model for a mathematics subject led to raising the level of their systemic thinking.
2-The students of the experimental group who studied according to the Perkins & Blythe model outperformed the students of the control group who studied according to the usual method in the systematic thinking skills test.Fourth:
Recommendations: Based on the results reached by the two researchers in their current research, they recommend the following:
1- Mathematics teachers' interest in the Perkins & Blythe model and other modern teaching models that emphasize understanding.
2- The necessity of including topics in middle school mathematics books that help develop students' systemic thinking skills.
3- Include in the teacher preparation programs in the faculties of basic education a course (developing thinking skills) within the courses.
Fifth: Suggestions: To complement the findings of the current study, the two researchers suggest the following:
1. Conducting a study of the effectiveness of the Perkins & Blythe model in other variables such as creative thinking, productive thinking, high-order thinking, and multiple intelligences.
2. Directing a study to determine the extent to which learners possess the skills of systemic thinking for the different academic stages.
3. Accompanying a comparative study between the (Perkins & Blythe) model and other models to find out which of them are more effective in systemic thinking skills.

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