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The Effectiveness of Using Interactive Science Notebook to Develop Sixth Grade (EFL) Pupils' Creative Thinking Skills and Their Achievement in Science

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The Effectiveness of Using Interactive Science Notebook to Develop Sixth Grade (EFL) Pupils' Creative Thinking Skills and Their Achievement in Science

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Abstract:

The purpose of this research was to determine the effectiveness of using an Interactive Science Notebook (ISN) to develop sixth grade (EFL) pupils' creative thinking skills and their achievement in science in the first semester of the academic year 2021-2022. It has provided insights about the Interactive Science Notebook (ISN) influence on pupils' creative thinking skills, and how Interactive Science Notebook (ISN) is an effective learning tool to increase pupils' academic achievement. The research utilized an Interactive Science Notebook. The research sample consisted of (30) participants in sixth grade, the sample was selected from two classes and distributed into two groups: an experimental group (n=14) and the control group (n=16) from Mansoura college language school. The finds showed the effectiveness of Using Interactive Science Notebook in teaching science in developing Some Skills of creative thinking and the achievement in science of primary stage pupils. There are statistically significant differences between the mean scores of the control group and the experimental group in the post-creative thinking skills test and the achievement test and the values of (U) were significant at 0.05 in favor of the experimental group.

Keywords:-Interactive Science Notebook, Creative thinking skills, Primary stage, Language schools.

1. Introduction:

Primary school pupils are naturally curious, they always want to know what would happen next and, are curious about everything around them, they are full of questions about things that interest them. against a background of tests and the traditional teaching ways, unscripted queries go mainly unanswered and learning opportunities are mostly lost.

In order to teach today's science concepts, pupils need to understand subject matter deeply and flexibly to create useful cognitive maps, relate one idea to another, and address alternative conceptions.

The development of creative and innovative skills is of central importance in science education and these skills ensure a strong relationship

between the information and the learning, so innovative teaching is required for creative learning [Ferrari, A., Cachia, R., & Punie, Y. 2009).

To help pupils understand science may be used interactive science notebook (ISN).

Waldman and Crippen (2009) stated that an interactive science notebook (ISN) provided techniques and opportunities for pupils to create an organized, documented record of their personal learning.

Interactive Science notebooks:

Interactive notebook- a spiral notebook that is used to organize information. The right side is used for teacher information (notes, lectures, discussions, handouts, etc.) The left side is used for pupil information (drawings, cartoons, personalized wording of vocabulary, etc.).(Young, 2003).

An interactive science notebook is a highly beneficial learning tool that develops pupils' communication skills, cognitive organization skills, and sense of responsibility for their own learning. The idea behind interactive notebooks is to engage pupils in collaborative inquiry as a way of learning science content. (Marcarelli, 2010).

1.1 Creative thinking skills:

(Torrance, 1966) defined creativity as: a process of becoming sensitive to a problem, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions, making guesses, or formulating a hypothesis about these deficiencies; testing and retesting these hypotheses and possibly modifying and retesting them; and finally communicating the results.

Sternberg defines creativity as an imaginative action fashioned to produce outcomes that are both original and of value (Sternberg, 2003).

2. The statement of the problem:

previous research has shown that primary school pupils were suffering from low levels of science achievement due to the time dedicated to teaching science in primary schools being low.

They also failed to share or change their ideas, thoughts, and answers with teachers, a partner, or in their science teams, also many pupils are not independent thinkers.

Through the researcher's work as a science teacher, noticed many pupils do not have either the time or the interest to do science so the pupils

put focus on earning grades instead of gaining knowledge from assignments and work throughout the year, they were not making strong connections with the material and, they were misunderstanding how to apply learned information.

They tend to be rote learners, and their motivation for real learning is low.so, pupils will be promoted to high school with minimal creative thinking skills.

The problem of the research is determined through the following main question:

What Is the Effectiveness of Using Interactive Science Notebook to Develop Sixth Grade (EFL) Pupils' Creative Thinking Skills and Their Achievement in Science?

This main question is subdivided into the following sub-questions:

1. What is the effectiveness of using Interactive Science Notebook (ISN) to develop sixth grade (EFL) pupils' creative thinking skills?
2. What is the effectiveness of using the ISN to develop sixth grade (EFL) pupils' achievement in science?

3. Hypotheses of the Research:

The research attempted to test the following hypotheses:

1. ***There is statistically significant difference at ($\alpha \leq 0.05$) between the mean scores of experimental group and the control group in the post - application of creative thinking test in favor of the experimental group.***
2. ***There is statistically significant difference at ($\alpha \leq 0.05$) between the mean scores of experimental group and the control group in the post - application of achievement test in favor of the experimental group.***

4. Research aims:

The current research aimed to identify the following aims:

- Identify the effectiveness of using interactive science notebook (ISN) to develop sixth grade (EFL) pupils' creative thinking skills.
- Identify the effectiveness of using the ISN to develop sixth grade (EFL) pupils' achievement in science.

5. Research Significance:

The significance of this research emerged in the following areas:

First, for teachers:

1. Shedding light on the importance of developing skills in creative thinking, which contributes to directing teachers' attention to its development among pupils, urging them to deal with an in-depth and effective view when teaching science.
2. Providing teachers with a guide on how to teach science using ISN.
3. Preparing a creative thinking test and an achievement test in science for teachers and postgraduate pupils.
4. Encouraging science teachers to adopt new ideas in teaching science learning.

Second: For pupils:

1. Training pupils to practice innovative thinking skills and develop their academic achievement helps them develop their academic abilities in their future majors, as well as on a personal and practical level in their lives. Hence, we are about to graduate a distinguished pupil who will benefit from what he has learned in school throughout his life.
2. Providing pupils with some methods that help them in achieving good academic achievement.
3. Helping pupils to engage in certain forms of formative assessment and teachers can give feedback on where they feel the pupils are as compared to where they need to be.
4. Improve Pupils' abilities to recognize, explore, and celebrate logical, rigorous thoughts and elegant reasoning.

6. Methodology:

6.1 Participants:

sixth grade pupils on *Mansoura College Language School* under the educational administration of *Talkha* as a sample for the experimental group. & Another class of sixth-grade pupils on *Mansoura college language school* as a sample of the control group.

6.2 Tools:

1. Creative thinking skills test.(prepared by the researcher)
2. Academic achievement test on science for the sixth pupils of primary stage.(prepared by the researcher)

6.3 Materials:

1- A list of creative thinking skills.

2- An interactive science notebook (prepared by the researcher)

3- Teacher‘s guide can use for teaching science using (ISN).

4- Pupil‘s activity book for " Structure and Function of the Living Organisms " unit of science book for sixth primary stage pupils.

6.4 Research limitations:

The current research was limited to the following points:

1- A sample from sixth-grade pupils.

2- Unit four in the book of science which was assessed to sixth primary pupils of the year 2021/2022.

3- The use of Interactive Science Notebook.

4- Measuring creative thinking skills(Fluency, Flexibility, Originality).

5- Achievement levels: (remembering, understanding, application).

6.5 Procedures:

The research has proceeded according to the following steps:

1. Review the educational literature and previous research related to the research to establish the theoretical framework.
2. Select the " Structure and Function of the Living Organisms " unit as a unit of experimentation.
3. Re-organizing the "Structure and Function of the Living Organisms" unit planned for pupils in the sixth grade of the primary stage using science supported by Interactive Science Notebook (ISN).
4. Preparing Interactive Science Notebook (ISN)on unit four "Structure and Function of the Living Organisms".
5. Preparing an activity book containing open-ended activities for the unit suits the nature of the Interactive Science Notebook (ISN).
6. Preparing the teacher guide to teach the unit by using Interactive Science Notebook (ISN).
7. Submitting the teacher‘s guide and (ISN) to a group of referees to make sure of the validity of the content and doing the modifications according to the opinions of arbitrators.
8. Preparing a list of creative thinking skills and presenting it to the arbitrators.
9. Preparing a test of Creative thinking skills.
10. Preparing a test of achievement.

11. Determining the psychometric parameters of the instruments.
12. Submitting the tests to a group of arbitrators to check their validity and doing modifications according to their opinions.
13. Identify the basic research sample and divide it into two groups (experiment and control).
14. Applying the pre-assessment tools of the research.
15. Teaching the experimental group using Interactive Science Notebook (ISN) and the traditional method to the control group.
16. Applying research instruments to pupils of experimental and control groups.
17. Correcting the test after and before the experiment and observe the results.
18. Analyzing data by using appropriate statistical methods in the light of the nature of the variables and sample size.
19. Discussing and interpreting the results.
20. Present a set of recommendations and suggestions in light of research results.

7. Review of literature:

Definition of Interactive Science Notebook (ISN).

Science notebooks are defined as "a compilation of entries that provide a partial record of the instructional experiences a pupil has in his or her classroom for a certain period. Through writing, pupils engage in authentic scientific thinking as they carry out their own investigations" (Shavelson, 2001, p. 2).

Science notebooks expose pupils' thinking, providing important insights about pupil understandings and serving as formative assessment tools as well as giving pupils many opportunities to develop and enhance pupils writing skills (Hargrove & Nesbit, 2003).

Usage of interactive science notebook.

The Interactive Science Notebook (ISN) has a specific "left-side," "right-side" organization that promotes conceptual understanding as pupils reflect upon the meaning of the material to be learned "An interactive notebook use to make connections prior to new learning, to revise their thinking, and to deepen their understanding" (Marcarelli, 2010).

According to Young (2003), the right side of an interactive notebook is best used for input activities, such as lectures and labs, while the

left side is used for output activities, such as drawings, reflections, and worksheets. Chesbro added to Young by stating an output activity should promote higher-order thinking skills.

Benefits of using interactive science notebooks.

The benefits of using interactive notebooks can be considered from three vantage points: developing pupils' thinking, increasing communication between stakeholders, and differentiating instruction (Young, 2003).

Using interactive notebooks in the classroom targets all the needs and helps develop the globally competitive pupil. Notebooks address these needs by:

- Creating a concrete record of reflection, assessment, and connections that can be viewed and discussed (Young, 2003).
- Notebooks encourage active learning and provide opportunities for pupils to pursue their own interests' authentic problems (Hargrove & Nesbit, 2003).
- Notebooks offer numerous opportunities to develop and enhance pupils 'writing skills (Young, 2003).
- Notebooks provide a structure and support for differentiated learning, helping all pupils to achieve (Gilbert & Kotelman, 2005).

A set of studies and research related to Interactive science notebooks such as:

There are a lot of research on the impact of Interactive Science Notebook (ISN) on teaching science:

- The research had shown that the integration of interactive science notebooks had a positive effect on pupil achievement in my secondary chemistry classroom, and it is a differentiated method of documenting pupils' thinking. (Alison Paige Dupuis, 2017)
- Notebooks encourage active learning and provide opportunities for pupils to pursue their own interests and tackle authentic problems (Hargrove & Nesbit, 2003; Gilbert & Kotelman, 2005).
- Some of the research on the use of notebooks focused directly on pupils' understanding of "doing science" and the nature of science and found that: Science notebooks engage pupils in authentic science processes, such as recording information and data and engaging in

research, collaboration, and analysis (Hargrove & Nesbit, 2003; Young, 2003).

Creativity and Creative Thinking

There is no consensus on the definition of creativity in the literature (Bacanli, Dombayci, Demir, & Tarhan, 2011). Therefore, there is a diversity of creativity definitions. Torrance, (1966) defined creativity as a process of becoming sensitive to a problem, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions, making guesses, or formulating a hypothesis about these deficiencies; testing and retesting these hypotheses and possibly modifying and retesting them, and finally communicating the results.

Furthermore, creativity has been described as "the ability to solve problems and fashion products and to raise new questions" (Gardner, 1993).

Creative Thinking Skills:

Guilford, (1950) proposed creativity as the ability to produce a new idea into existence via divergent thinking or arrive at many solutions to a problem and offer three dimensions to describe creativity:

1- Fluency: ability to generate lots of ideas, which loosens up the creative wheels. The first step to problem-solving or any creative endeavor is having as many ideas as possible to choose from, play with, research, or evaluate. Fluency is classified as associational fluency, ideational fluency, expressional fluency, and figural fluency. (Kim, 2005).

2- Flexibility: the ability to look at a question or topic from multiple perspectives. In science, flexible pupils think of different types of variables that may impact a phenomenon, and discover whole new areas of possibility, including different interpretations of scientific data.(Kim, 2005).

3- Originality: is the crux of creativity. This means generating unique or unusual products, and unexpected ideas. Each creative skill works as a part of the total creative process (Meador, 1997).

Tests for Measuring Creative Thinking Skills:

To enhance creativity, there must be measurable indicators to evaluate how much pupils have gained from learning. The formal psychometric measurement of creativity is usually considered to have begun with Guilford, (1950). Guilford's group constructed several tests to measure creativity in 1967 such as:

1. Plot Titles: where participants are given the plot of a story and asked to write original titles.
2. Quick Responses: this is a word-association test scored for uncommonness.
3. Figure Concepts: where participants were given simple drawings of objects and individuals and asked to find qualities or features that are common in two or more drawings; these were scored for uncommonness.
4. Unusual Uses: finding unusual uses for common everyday objects such as bricks.
5. Remote Associations: where participants are asked to find a word between two given words, and
6. Remote Consequences: where participants are asked to generate a list of consequences of unexpected events.

Building on Guilford's work, Torrance developed the Torrance Tests of Creative Thinking (TTCT) in 1966.

The TTCT-Verbal and the TTCT-Figural are two versions of the TTCT. The TTCT-Verbal has two parallel forms, A and B, and consists of five activities: ask-and-guess, product improvement, unusual uses, unusual questions, and just suppose. The stimulus for each task includes a picture to which people respond in writing (Torrance, 1966, 1974). For the purposes of this research, the TTCT- Verbal (B) Form has been used to Measure Creative Thinking Skills.

Creativity research in Science Education:

Creativity researchers have been studying these topics since the 1950s. However, this research has had surprisingly little impact on schools (Sawyer, 2011). Moreover, empirical research to research the development of creativity in regular science lessons Arabian countries are still lacking (Cheng, 2011; Dagher & Boujaoude, 2011).

Perhaps as was put forward years earlier by (Okere, 1986), this situation could give the impression that educational experiences in many Asian and Arabian schools are not enhancing creativity in physics Typically, pupils are required in physics lessons to describe physics phenomena, calculate quantities, and conduct an experiment which is carefully pre-specified as to their procedures and outcomes by teachers and textbook.(Diakidoy & Constantinou, 2001).

Creativity is supported, deliberate, and meaningful while still connected to the curriculum, not teaching separate lessons or developing new materials (Shively, 2011). and make outstanding grades in science due to their ability to memorize and retain information (Meador, 2003).

In the science classroom, teaching creativity helps pupils to improve attitudes, abilities, and behaviors in creative science development. (Cheng, 2011).

8. Research procedures:

Selecting the content:

The unit " Structure and Function of the Living Organisms " was chosen from the sixth-grade curriculum.

Preparing the teacher's guide

The teacher's guide was prepared for teaching the "Structure and Function of the Living Organisms" unit by reformulating the unit in the first semester of the year 2021-2022.

Preparing the activity book of Science Supported with using (ISN):

The pupil's activity book included a set of questions and activities that suits to use of interactive science notebooks.

Preparing the research instruments:

After reviewing the previous research and literature related to (ISN), and creative thinking skills, the following materials and instruments were prepared by the researcher:

8.1 Creative thinking skills Test:

Identifying its purpose:

The test aims at measuring the extent to which sixth-grade pupils have mastered creative thinking skills. It includes: (The skill of Fluency, Flexibility, and Originality).

Writing the test instructions:

The test instructions wrote in the form of clear, easy, and appropriate items for the pupils' level.

Evaluation of pupil's grades on the test (Correction key):

After reviewing the standards of the Torrance Test of Creative Thinking correction (Torrance, 1990), the Investigator prepared a list of criteria to correct pupils' responses in each of the skills of fluency,

flexibility, and originality by using the responses sheet. Then, the instructions for scoring were recognized.

1. Fluency Skill

It is measured by the total number of responses. It means that one mark is given for each response. The inappropriate response was ignored.

2. Flexibility Skill

It is measured by the degree of difference of responses for each activity. One mark is given for each specific response area in the category.

3. Originality Skill

The originality skill is the most difficult skill to evaluate the pupils' marks. It was measured by the statistical infrequency of responses. According to Torrance, one mark is given for each response but not more than (5%) of pupils' frequency responses. In case there are 4% responses, each pupil is given two marks. If 3%, each pupil is given three marks. If 2%, each pupil is given four marks. But in case, there are only 1% of frequency responses, the pupil is given five marks.

Validity of the test:

The initial form of the creative thinking skills test consisting of (5) tasks was submitted to a group of jury members and specialists in curricula and methods of teaching science*; In order to know their points of view on the test, the results of the judge approved the clarity of the test instructions and the relevance of its items to the level of primary school pupils. Thus, the test in its initial form became valid for application to the survey research sample. some modifications were suggested, like:

1. Rephrasing some items to be simple and clear.
2. Providing some phrases that one more suitable to the question of the test
3. Delete question 6 to suit the age group.
4. The number of responses has been adjusted from 25 to 12 for all questions.

In light of the jury members' modifications, the test becomes ready to be applied at the piloting of the sample.

Determination of test time:

The researcher found that the adequate time to answer the items of the test was (35 minutes), containing 5 min for giving instructions. The test

time was valued by calculating the mean value of time of all pupils on the test.

Verifying the clarity of questions, and test instructions:

The researcher noticed that the pupils had not any questions related to the test items or their instructions and that clarifies the appropriateness of the test items for the pupils‘ linguistic level.

The (internal consistency) of skills is estimated by calculating the correlation coefficient between the total scores of each skill and the total score of the test as shown in table (1):

Table (1): The Internal Consistency of The Creative Thinking Test.

dimensions	**Internal consistency**
Fluency	**0.915****
Flexibility	**0.940****
Originality	**0.839****

The dimensional correlation coefficients with the total score of the test came as a function at the 0.01 level. Therefore, the test scores were reliable and had an acceptable degree of internal consistency. It can be used to measure creative thinking skills with the main sample.

8.٢ The achievement test:

Identifying its purpose:

The achievement test purposed to:

1. Measure the prior knowledge of pupils about the scientific concepts that are included in Structure and Function of the Living Organisms unit before teaching by the pre-test.
2. Measure the extent to which pupils of grade six have the learning outcomes which included in Structure and Function of the Living Organisms unit in science by the post-test.
3. The Bloom‘s cognitive domain taxonomy was taken into consideration in creating the achievement test.

Table of content for the achievement test:

The table was constructed according to the following steps:

Determining the relative weight of content according to the cognitive structure:

The unit content and its cognitive structure were detected and divided into (facts, concepts, principles, laws, and theories) as in table (2)

Relative weight of content according to the cognitive structure

Table (2)

Lesson	Facts	Concepts	generalizations	Scientific laws	Scientific theories	Total	Relative weight
Human Nervous System.	12	10	1	-	-	23	61%
Human Locomotory System.	9	6	-	-	-	15	39%
Total	21	16	1	-	-	38	100%

Determining the relative weight of content according to the page numbers:

Table (3)

Lesson	Number of pages	Relative weight
1- Human Nervous System.	8	57%
2- Human Locomotory System.	6	43%
Total	14	100%

Determining the relative weight of content according to the number of sessions: Table (4)

Relative weight of content according to the number of sessions

Lesson	Number of sessions	Relative weight
1- Human Nervous System.	5	62%
2- Human Locomotory System.	3	38%
Total	8	100%

Writing the test items:

The achievement test items, and its level were written as follows:

The following points were taken into consideration:

1. Questions represent the educational goals to be achieved.
2. Random distribution of answers.
3. Each question has four alternatives of equal relative length, so the pupils do not have the opportunity to guess.
4. Appropriateness of the questions to the content.
5. Clarity and ease of the question language, linguistic and scientific accuracy.
6. Appropriateness of the questions to the level of pupils.

7. Numbering the test questions in numbers (1, 2, 3….) and alternatives with letters (a, b, c, d).

Writing of test instructions:

The researcher wrote a set of test instructions in order to clarify the test‘s purpose to the pupils, guide them to answer questions in an organized way, and give an example of the way of answering as well as the given time that was identified for answering.

Evaluation of pupil’s grades on the test (Correction key):

The Marks of the test scores range from (zero to 20 marks as a maximum), therefore the pupil gets the value of the question according to the following:

- (One) if he provided the correct answer.
- (Zero) if he provided a wrong answer.

Validity of the test:

The initial form of the achievement test consisting of (20) items was presented to a group of jury members and specialists in curricula and methods of teaching science; In order to know their points of view on the test, the judgment‘s results showed the clarity of the test instructions, the relevance of its items, its connection with the scientific concepts of interest, its suitability to the mental level, and the linguistic of primary school pupils. Thus, the test in its initial form became valid for application to the survey sample.

Determination of test time:

The researcher found that the adequate time to answer the items of the test was (40 minutes), containing 5 min for giving instructions. The test time was valued by calculating the mean value of time of all pupils on the test.

Verifying the clarity of questions, and test instructions:

The researcher noticed that the pupils had not any questions related to the test items or their instructions and that clarifies the appropriateness of the test items for the pupils‘ linguistic level.

Calculating the internal consistency of the test:

The internal consistency of the test was calculated by determining the correlation coefficients between the total score of each cognitive level and the total score of the test.

Variables:

Research variables were classified into:

A- Independent variables:

1- (Using Interactive Science Notebook) for the experimental group.

2- (Using traditional teaching method) for the control group.

B-Dependent variables:

1- Creative thinking skills Test.

2-Academic achievement.

9. Analysis of Finds:

Table (5): U- value & Significant difference between the two (control - experimental) groups in creative thinking skills and the total score for the post test.

Skills	groups	n	Mean rank	Sum of ranks	U	Z	Sign.	η^2
Fluency	Exp.	14	301.50	21.54	27.5	3.526	0.05	0.64
	control	16	163.50	10.22				
Flexibility	Exp.	14	309.00	22.07	20	3.838	0.05	0.70
	control	16	156.00	9.75				
Originality	Exp.	14	264.50	18.89	64.5	2.013	0.05	0.37
	control	16	200.50	12.53				
Total Score	Exp.	14	306.50	21.89	22.5	3.731	0.05	0.68
	control	16	158.50	9.91				

The first hypothesis of the research was tested, which states: There is statistically significant difference at (0. 05) between the mean scores of experimental group and the control group in the post - application of creative thinking test in favor of the experimental group.

Table (5) shows that, there are statistically significant differences between the mean scores of the control group and the experimental group in the creative thinking skills test and the values of (U) were significant at 0.05 in favor to the experimental group. so, the first hypothesis of the research was accepted.

The results show the following:

1- The effect size of using Interactive Science Notebook on developing Fluency skill was (0.64). That means the variance of the dependent variable due to the effect of the independent variable is 64% that considered having a high effect.

2- The effect size of using Interactive Science Notebook on developing Flexibility skill was (0.70). That means the variance of the dependent variable due to the effect of the independent variable is 70% that considered having a high effect.

3- The effect size of using Interactive Science Notebook on developing Originality skill was (0.37). That means the variance of the dependent variable due to the effect of the independent variable is 37% that considered having a high effect.

4- The effect size of using Interactive Science Notebook on developing creative thinking skills was (0.68). That means the variance of the dependent variable due to the effect of the independent variable is 68% that is considered to have a significant effect.

It is obvious that the value of η^2 for all skills is an accepted value. And it is clear from the previous table that all values of η^2 were higher than 0.15, which means that there are statistical differences between the mean scores of the significant effectiveness and size of the experimental group in developing creative thinking skills

It has been concluded that teaching science supported with Interactive Science Notebook (ISN) is effective in improving some of creative thinking skills.

The data results reveal that the development of creative thinking skills could be affected by the following factors:

1. Previous experiences for each pupil.
2. Elements of the environment in which pupils live.
3. The role of culture in society to explain what pupils see and think.
4. Ability of pupils to form an imaginary image and express it clearly.

The effectiveness of using Interactive Science Notebook on teaching science in developing some creative thinking skills could be due to: Using activities that stimulate the thinking of pupils and facilitate the development of creative thinking skills.

Interactive Science Notebook uses both the right and left-brain hemispheres to help Pupils sort, categorize, remember, and creatively interact with the new knowledge they are gaining. The more Pupils process the information, the more they begin to understand it. and this leads to longer retention.

Table (6): U-test of the post-test comparing the control and the experimental groups in the total score of achievement test.

dimensions	groups	n	Mean rank	Sum of ranks	U	Z	Sign.
knowledge	Exp.	14	18.89	264.50	64.5	2.187	0.05
	control	16	12.53	200.50			
comprehension	Exp.	14	18.79	263.00	66	1.999	0.05
	control	16	12.63	202.00			
Application	Exp.	14	20.68	289.50	39.5	3.151	0.05
	control	16	10.97	175.50			
Total Score	Exp.	14	20.61	288.50	40.5	2.992	0.05
	control	16	11.03	176.50			

The second hypothesis of the research was tested, which states: There is statistically significant difference at (0. 05) between the mean scores of experimental group and the control group in the post - application of achievement test in favor of the experimental group.

From the previous table, there are statistically significant differences between the mean scores of the control group and the experimental group in cognitive levels and total score of achievement test. The values of (U) were at the significance level of 0.05 in favor of experimental group. The total value of (U) on the achievement test (40.5).so the second hypothesis of the research was accepted.

The results show the following:

1. The effect size of using Interactive Science Notebook on developing knowledge was (0.40). That means the variance of the dependent variable due to the effect of the independent variable is 40% that considered having a high effect.
2. The effect size of using Interactive Science Notebook on developing comprehension was (0.36). That means the variance of the dependent variable due to the effect of the independent variable is 36% that considered having a high effect.
3. The effect size of using Interactive Science Notebook on developing Application was (0.58). That means the variance of the dependent variable due to the effect of the independent variable is 58% that considered having a high effect.
4. The effect size of using Interactive Science Notebook on developing (EFL) Pupils' achievement in science was (0.55). That means the variance of the dependent variable due to the effect of the independent variable is 55% that is considered to have a significant effect.

The data results reveal that the usage of Interactive Science Notebooks was helpful in pupils being more successful on an achievement test.

10. Discussion:

The effectiveness of using interactive science notebook (ISN) to develop sixth grade (EFL) pupils' creative thinking skills and their achievement in science may refer to:

- The interactive notebook became real evidence of pupil learning and thinking, a shaping tool for future productive citizens in the science world.
- Connecting pupils' thinking and experiences with science concepts.
- Interactive Science Notebook (ISN) supported scaffolded learning where each pupil used the prior knowledge to build a new one.
- Through using Interactive Science Notebook (ISN), The ability of the pupils to organize information will also be developed who plan on pursuing a higher level of education or even for those who plan to pursue careers where organizing data is important.
- Introducing the open-ended questions and riddles attracted the attention of pupils as a hook and challenge their mental abilities to generate creative ideas.
- The performance of science experiments increased the interest of pupils in the topics.
- Using the (ISN) helped pupils to take ownership of their learning in that they have to provide feedback and create some form of product from their interaction with the material being taught to them.
- The (ISN) provides pupils with an opportunity to think critically and make informed decisions.
- Pupils are motivated to share their own ideas.
- Using activities that stimulate the thinking of pupils and facilitate the development of creative thinking.
- make informed decisions.
- Pupils doing higher levels of cognitive thinking. Genuine conversation and discussion about the topic, a welcome and safe classroom environment with "Real world learning and connections".

- Pupils attached great importance to Interactive Science Notebook (ISN) in the development of the individual's creative potential.

11. Conclusions:

Conclusions Based on the results of the current research, the following could be concluded:

1- Results of the research have shown the effectiveness of Using Interactive Science Notebook in teaching science in developing Some Skills of creative thinking and the achievement in science of primary stage pupils. There are statistically significant differences between the mean scores of the control group and the experimental group in the post-creative thinking skills test and the values of (U) were significant at 0.05 favor of the experimental group.

2- Using Interactive Science Notebook was effective in developing primary school pupils' creative thinking skills. The pupils improved their abilities to recognize, explore, and celebrate logical, rigorous thoughts and elegant reasoning. and providing hands-on activities oriented to improving pupils' understanding of a science concept.

3- Using an interactive notebook allows a pupil to think, record data and observations, and reflect just as professional scientists do.

4- it helps pupils build deep understandings of science subject matter and of scientific inquiry.

5- The interactive science notebook allows pupils the opportunity to identify their preexisting ideas, deepen and refine their scientific ideas throughout the learning activities, and reflect on their learning.

6- Through using science supported with Interactive Science Notebook, the pupils were helped to Elicit and address pupils' prior conceptions of scientific phenomena. and helped pupils monitor and take control of their own learning (metacognition).

7- In addition to the previous benefits of the Interactive Science Notebook on Teaching Science, it can help expose pupils' thinking, providing important insights about pupil understandings and serving as formative assessment tools that lead to the development of higher-order thinking skills and creative, Analytical, or logical, thinking skills. Creative thinking skills are also provided; these consist of problem finding, efficiency, flexibility, originality, and elaboration.

8- Science notebooks engaged pupils in authentic science processes.

12. Recommendations:

In the light of the present research results and conclusion, the following would be recommended:

1- It is necessary to change teachers' traditional way of teaching science.

2- Teachers need to be exposed to interactive notebooks as an effective classroom tool for increasing pupil achievement.

3- They need to weigh the advantages and disadvantages of interactive notebooks as they decide when to use them. When used properly, interactive notebooks can be effective organizational tools for the teacher and pupils.

4- It is recommended to focus on the professional qualifications of teachers and provided them with training on teaching science using interactive science books.

5- It is recommended to promote pupil engagement through active learning through interesting activities Indispensable to practical activities.

6- It is necessary to train pupils to produce and generate new inspired artistic ideas by taking advantage of what they learn; Creating an interactive environment between teachers and pupils based on respect, freedom, nonadherence to specific ideas, and encouraging dialogue and discussion.

13. Suggestions for further research: In the light of the research findings and results, the following are suggested for further research:

1. Further research is needed in the field of interactive notebooks, where there is very little research about the benefits or limitations of interactive notebooks.

2. Research needs to be done that directly correlates pupil achievement levels and success to interactive notebooks, research needs to be designed that correlates the two pieces.

3. Further research would be needed to examine the effect of using interactive science notebooks on developing other creative thinking skills.

4. Further research is needed to investigate the effectiveness of using interactive science notebooks in developing teachers' perceptions of the incorporation of interactive notebooks in science lessons.

5. This research could be replicated at a different level of education with a larger sample.
6. Investigating the use of test-taking strategies in developing other language skills and sub-skills.

References

Chesbro, R. (2006), Using interactive notebooks for inquiry-based science, *Science Scope, 29*.

Dombayci, M.A., Demir, M., Tarhan, S. and Bacanli, H. (2011) Quadruple thinking: Caring thinking. Procedia Social and Behavioral Science, 12.

Ferrari, A., Cachia, R., & Punie, Y. (2009). Innovation and Creativity in Education and Training in the EU Member States: Fostering Creative Learning and Supporting Innovative Teaching. JRC Technical Notes. Publication of the European Community ,761 .

Gilbert, J., & Kotelman, M. (2005). Five good reasons to use science notebooks. Science and Children, 28-32.

Guilford, J. P. (1950). Fundamental statistics in psychology and education. 2nd Edition. McGraw-Hill. 444-454.

Kim, K.H. (2006). Can we trust creativity tests? A review of the Torrance Tests of Creative Thinking (TTCT). Creativity Research Journal, 18,83-98.

Kim, K.H. (2005) Can only intelligent people be creative? A meta-analysis The Journal of Secondary Gifted Education 18,83-98.

Marcarelli, K. (2010). Teaching science with interactive notebooks. Thousand Oaks, CA: Corwin. 6-11.

Meador, K. S. (1992). Emerging Rainbows: A Review of the Literature on Creativity in Preschoolers. Journal for the Education of the Gifted, 15(2), 163-181.

Meador, K. S. (2003) Thinking creatively about science: Suggestions for primary teachers. Gifted Child Today, 26(1), 25-29.

Nesbit, C., Hargrove, T., Harrelson, L., & Maxey, R. (2003).Implementing science notebooks in the primary grades. Submitted for publication. 33-32

Torrance, E. P. (1966). Torrance Tests of Creative Thinking. Lexington, XX: Personnel Press.30.

Waldman, C. & Crippen, K. (2009). Integrating interactive notebooks. The Science Teacher, January 2009, 51-55.

Young, J. (2003, January). Science interactive notebooks in the classroom. Science Scope. 26: 44-46.