مجلة الدراسات والبحوث التربوية

JOURNAL OF STUDIES AND EDUCATIONAL RESEARCHES

المجلد (١) العدد (١) يناير ٢٠٢١ م

مجلة علمية دورية محكمة

يصدرها مركز

العطاء

للإستشارات التربوية - الكويت

JSER

الرقم المعيارى الدولى

ISSN: 2709-5231

Journal of Studies and Educational Researches مجـــلة الدراســات والبحـوث التربـــوية

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Journal of Studies and Educational Researches (JSER)

علمية دورية محكمة يصدرها مركز العطاء للاستشارات التربوية- دولة الكويت

ISSN: 2709-5231

التعريف بالمجلة

تصدر مجلة الدراسات والبحوث التربوية عن مركز العطاء للاستشارات التربوية- دولة الكويت كل أربعة شهور، وهي مجلة علمية دورية محكمة بإشراف هيئة تحرير وهيئة علمية تضم نخبة من الأساتذة، وتسعى المجلة للإسهام في تطوير المعرفة ونشرها من خلال طرح القضايا المعاصرة في مختلف التخصصات التربوية، والاهتمام بقضايا التجديد والإبداع، ومتابعة ما يستجد في مختلف مجالات التربية؛ وتقوم بعض قواعد المعلومات الدولية بتوثيق أبحاث المجلة لديها، ومنها شمعة Shamaa.

أهداف المجلة

تهدف المجلة إلى دعم الباحثين في مختلف التخصصات التربوية من خلال توفير وعاء جديد للنشر يلبي حاجات الباحثين داخل الكويت وخارجها. ويمكن تحديد أهداف المجلة بشكل تفصيلي في الأهداف الأربعة التالية:

1. المشاركة الفاعلة مع مراكز البحث العلمي لإثراء حركة البحث في المجال التربوي .
2. استنهاض الباحثين المتميزين للإسهام في طرح المعالجات العلمية المتعمقة والمبتكرة للمستجدات والقضايا التربوية.
3. توفير وعاء لنشر الأبحاث العلمية الأصيلة في مختلف التخصصات التربوية .
4. متابعة المؤتمرات والندوات العلمية في مجال العلوم التربوية.

مجالات النشر في المجلة

تهتم مجلة الدراسات والبحوث التربوية بنشر الدراسات والبحوث التي لم يسبق نشرها في مختلف التخصصات التربوية، على أن تتصف بالأصالة والجدة، وتتبع المنهجية العلمية، وتراعي أخلاقيات البحث العلمي. كما تنشر المجلة ملخصات رسائل الماجستير والدكتوراه ذات العلاقة بمختلف التخصصات التربوية، والمراجعات العلمية، وتقارير البحوث والمراسلات العلمية القصيرة، وتقارير المؤتمرات والمنتديات العلمية، والكتب والمؤلفات المتخصصة في التربية ونقدها وتحليلها.

القواعد العامة لقبول النشر في المجلة

1. تقبل المجلة نشر البحوث باللغتين العربية والإنجليزية وفقاً للمعايير التالية:

- توافر شروط البحث العلمي المعتمد على الأصول العلمية والمنهجية المتعارف عليها في كتابة البحوث الأكاديمية في مجالات التربية المختلفة.
- أن تحتوي الصفحة الأولى من البحث على:
  - اسم الباحث ودرجته العلمية والجامعة التي ينتمي إليها.
  - البريد الإلكتروني للباحث.
  - ملخص للبحث باللغة العربية والإنجليزية في حدود (150) كلمة.
  - الكلمات المفتاحية بعد الملخص.
- ألّا يزيد عدد صفحات البحث عن (30) صفحة متضمنة الهوامش والمراجع.

- أن تكون الجداول والأشكال مُدرجة في أماكنها الصحيحة، وأن تشمل العناوين والبيانات الإيضاحية الضرورية، ويُراعى ألّا تتجاوز أبعاد الأشكال والجداول حجم الصفحة.
- أن يكون البحث ملتزماً بدقة التوثيق حسب دليل جمعية علم النفس الأمريكية APA الإصدار السادس، وحسن استخدام المصادر والمراجع، وتثبيت مراجع البحث في نهايته.
- أن يكون البحث خالياً من الأخطاء اللغوية والنحوية والإملائية.
- أن يلتزم الباحث بالخطوط وأحجامها على النحو التالي:
  - اللغة العربية: نوع الخط (Sakkal Majalla)، وحجم الخط (14).
  - اللغة الإنجليزية: نوع الخط (Times New Roman)، وحجم الخط (14).
  - تكتب العناوين الرئيسية والفرعية بحجم (16) غامق (Bold).
  - أن تكون المسافة بين الأسطر (1.15) بالنسبة للبحوث باللغة العربية، وتكون المسافة بين الأسطر (1.5) بالنسبة للبحوث باللغة الإنجليزية.
  - تترك مسافة (2.5) لكل من الهامش العلوي والسفلي والجانبين.

2. ألاّ يكون البحث قد سبق نشره أو قُدم للنشر في أي جهة أخرى.

3. تحتفظ المجلة بحقها في إخراج البحث وإبراز عناوينه بما يتناسب وأسلوبها في النشر.

4. ترحب المجلة بنشر ما يصلها من ملخصات الرسائل الجامعية التي تمت مناقشتها وإجازتها في مجال التربية، على أن يكون الملخص من إعداد صاحب الرسالة نفسه.

5. بالمجلة باب لنشر موضوعات تهم المجتمع التربوي يكتب فيه أعضاء التحرير.

إجراءات النشر في المجلة

1. ترسل الدراسات والبحوث وجميع المراسلات باسم رئيس تحرير مجلة الدراسات والبحوث التربوية على الإيميل التالي: **submit.jser@gmail.com**

2. يرسل البحث إلكترونياً بخطوط متوافقة مع أجهزة (IBM)، بحيث يظهر في البحث اسم الباحث ولقبه العلمي، ومكان عمله.

3. يُرفق ملخص البحث المراد نشره في حدود (100-150 كلمة) سواء كان البحث باللغة العربية أو الإنجليزية، مع كتابة الكلمات المفتاحية الخاصة بالبحث (Key Words).

4. يرفق مع البحث موجز للسيرة الذاتية للباحث.

5. في حالة قبول البحث مبدئياً يتم عرضه على مُحكّمين من ذوي الاختصاص في مجال البحث، لإبداء آرائهم حول مدى أصالة البحث وقيمته العلمية، ومدى التزام الباحث بالمنهجية المتعارف عليها، وتحديد مدى صلاحية البحث للنشر في المجلة من عدمها.

6. يُخطر الباحث بقرار صلاحية بحثه من عدمها خلال شهر من تاريخ استلام البحث.

7. في حالة ورود ملاحظات من المحكمين تُرسل إلى الباحث لإجراء التعديلات اللازمة، على أن يعاد إرسال البحث بعد التعديل إلى المجلة خلال مدة أقصاها شهر.

8. تؤول جميع حقوق النشر للمجلة.

9. لا تلتزم المجلة بنشر كل ما يرسل إليها.

10. المجلة لا ترد الأبحاث المنشورة إليها سواء كانت منشورة أو غير قابلة للنشر، وللمجلة وإدارتها حق التصرف في ذلك.

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المحتويات

الافتتاحية

بسم الله الرحمن الرحيم، عليه نتوكل وبه نستعين، نحمده سبحانه كما ينبغي أن يحمد ونصلي ونسلم على أشرف المرسلين سيدنا محمد وعلى آله وأصحابه والتابعين وبعد،،،

يشهد العالم ثورة معلوماتية كبرى منذ منتصف القرن الماضي بسبب التطور السريع والهائل لتكنولوجيا الإعلام والاتصال، وقاد هذا إلى تغير العديد من المفاهيم والأسس داخل المجتمع، فلم تعد المعدات والآلات الثقيلة ورأس المال الأدوات الرئيسية للنشاط الاقتصادي، إذ حلت محلها المعرفة التي أصبحت المحرك الأساسي للنشاط الاقتصادي والفردي في كل المجتمعات، وقد أدى تزايد قيمة المعرفة في العصر الحالي إلى أن أصبحت هي الطريق نحو مجتمع المعرفة الذي تتنافس الدول في تحقيقه.

وقد جعل ذلك الدول المتقدمة تنفق حوالي (20%) من دخلها القومي في استيعاب المعرفة، ويستحوذ التعليم على نصف هذه النسبة، كذلك تنفق المنظمات الصناعية والتجارية في هذه الدول ما لا يقل عن (5%) من دخلها الإجمالي في التنمية المهنية للعاملين بها، وتنفق ما يتراوح بين (3%-5%) من دخلها الإجمالي في البحث والتنمية.

ويعد البحث العلمي الوسيلة الرئيسية لإيجاد المعرفة وتطويرها وتطبيقها في المجتمع، كما يشكل الركيزة الأساسية للتطور العلمي والتقني والاقتصادي، ويساهم في رقي الأمم وتقدمها، وهو بمثابة خطوة للابتكار والإبداع، ويمثل البحث العلمي إحدى الركائز الأساسية لأي تعليم جامعي متميز، ويعد من أهم المعايير التي تعتمدها الجهات العلمية في تصنيف وترتيب الجامعات سواء علي المستوي المحلي أو القومي أو العالمي؛ ويقاس التقدم العلمي لبلد من البلدان بمدى الناتج البحثي والعلمي مقارنةً بالدول الأخرى.

ويسر مجلة الدراسات والبحوث التربوية أن تقدم لقرائها هذا العدد، وتتقدم أسرة المجلة بالشكر إلى جميع الباحثين الذين ساهموا بأبحاثهم في هذا العدد، وتجدد دعوتها لجميع الباحثين للالتفاف حول هذا المنبر الأكاديمي بمساهماتهم العلمية. وندعو الله عز وجل السداد والتوفيق.

رئيس التحرير

أ.د/ محسن حمود الصالحي

The Effect of Infographic on Achievement, Development of Visual Thinking Skills and Orientation Towards Science of Primary School Students in the State of Kuwait

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Abstract: The aim of the study is to identify the effect of using Infographic on achievement, development of visual thinking skills and the orientation towards science of fifth grade students in the State of Kuwait. The study followed the semi-experimental method. The sample consisted of (64) students, divided into two groups: an experimental group consisting of (34) students studied using Infographic, and a control group consisting of (30) students studied using the conventional methodology. The study tools included an achievement test, visual thinking test, and a measure of the orientation towards science. The results showed that there were statistically significant differences at the level of (0.05) between the average of the experimental group and the control group in the post application of study tools in favor of the experimental group.

Keywords: Infographic - Visual Thinking - The Orientation Towards Science.

Introduction:

Today, the world is experiencing a comprehensive scientific revolution, and it is witnessing a great and rapid development in the field of information and communication technology, and this has led to an unprecedented flow of knowledge and information in various fields of life, and we are facing a huge amount of information and data, which necessitated relying on new means to absorb this knowledge and information And employ it and take advantage of it.

Infographic technology has appeared with its various designs in an attempt to give a new visual form to display information or transfer data in attractive images to students, and the infographic designs are important because they change the way of thinking towards complex data and information, as the infographic technology helps the educational process in presenting the curriculum In a new and interesting style (Shaltout, 2014, 47).

Infographic designs also contribute to simplifying information and ease of reading the vast amount of data, and making this data more smooth in reading and knowing it, and the ability to analyze it in a beautiful and attractive manner. In displaying information and communicating it to the recipient. That is, it achieved the simplification of information and complex data and transforming it from boring numbers and letters into interesting pictures and drawings with the ease of publishing and spreading it through electronic applications (Issa, 2014, 5).

Infographic is a technical term that refers to converting complex information and data into pictorial drawings that can be easily absorbed by those who see it without having to read a lot of texts (Issa, 2014, 12). Infographic is called by many names, including: Graphic Information, Visualization, Data Visualization, Information Design, Information Architecture, Smiciklas, 2012, 3 & Polman, Gebre, 2015, 868).

The designer's priorities when designing infographics in the field of education are ease of understanding, attention grabbing, and suspense (Lankow, et al., 2012, 38); Studies have shown that the brain's processing of visual information (such as infographic) is less complex than its processing of raw texts (Abdel-Basit, 2015, 15).

Therefore, some argue that there is an urgent need for graphics and visual information in order to be thought of and preserved (Muhammad and Rady, 2006, 105). Others believe that the two types of infographic, static and moving, have characteristics that affect children's visual thinking (Darwish and Al-Dakhni, 2015, 272). Visual thinking is a non-analytical, nor algorithmic, pattern that consists of an overlapping of three strategies: Design Thinking, Vision Thinking, Perception Thinking, and it depends on two processes, vision and imagination, where visual imagination depends on abstract laws related to the educational position, so visual thinking precedes visual imagination (Obaid Afana, 2003, 43). Visual thinking skills depend on the description, interpretation, deduction and distinction of the visual form (Al-Afoun and Al-Sahib, 2012).

Visual thinking is often associated with the right hemisphere of the brain, and the visual-spatial learner model is based on new discoveries in brain research about the different functions of the two hemispheres of the brain, for example the left hemisphere is believed to be an analytical sequential information processor that takes time into account, while the right hemisphere perceives all And he understands movement in place (Badawi, 2008, 128). Many educators and researchers advocate the necessity of teaching thinking skills to students as a modern demand imposed by contemporary life variables because they do not automatically grow through maturity or natural development, but through purposeful and structured teaching of these skills (Aziz, 2005, 94).

The Problem of study:

Through the researcher's review of many previous studies, he concluded that most programs based on science education focus on memorization and indoctrination, neglecting the active, active role of the learner, and the Kuwaiti environment lacks the use of teaching methods to develop visual thinking skills, and given the scarcity of interest in infographic in teaching science content at the stage Elementary school in the State of Kuwait, and the researcher's desire to teach the content of the science curriculum using infographics to develop pupils' visual thinking skills in order to be able to relate previous information to reality, predict the future, and develop solutions to problems.

And the researcher's attempt to draw attention to studies related to infographic that helped achieve many goals and the success of the educational process, and the researcher noticed the low achievement and weakness of visual thinking skills in science among elementary school students. Some studies have recommended the importance of using infographics in teaching science curricula at all educational levels (Awadallah, 2015).

Some studies have found the effectiveness of infographics in developing students 'achievement, such as the study of: Abd al-Samad (2017), Hassouna (2017), Ismail (2016), Awadallah (2015), and some studies have reached the effectiveness of the infographic in developing visual thinking skills in Students like the study of: Abu Zaid (2016), Darwish and Al-Dukhani (2015), and then it can be used in developing visual thinking skills and achievement in the study

sample. Which necessitated the need to conduct this study. Therefore, this study came in an attempt to answer the following main question:

What is the effect of the infographic on the achievement and development of visual thinking skills and the trend towards science for elementary school students in the State of Kuwait?

It is divided into the following sub-questions:

1. What is the effect of using infographics in science education on the achievement of fifth grade pupils in the State of Kuwait?
2. What is the effect of using infographics in science education on developing visual thinking skills among fifth grade students in the State of Kuwait?
3. What is the effect of using infographics in science education on the development of the trend towards science among fifth grade students in the State of Kuwait?

Objectives of study:

1. Identify the effect of using infographics in science teaching on the achievement of fifth grade pupils in the State of Kuwait.
2. Determining the effect of using infographics in science education on developing visual thinking skills among fifth grade students in the State of Kuwait.
3. Exploring the effect of using infographics in science education on developing the trend towards science among fifth-grade students in the State of Kuwait.

Importance of study:

- The importance of the study stems from the importance of the topic it deals with, which is infographic and its role in achieving many goals in the educational process.
- The results of the study may be useful in providing some recommendations and proposals that contribute to improving the reality of

using infographics in teaching academic courses in general and the science course in particular.

Study hypotheses:

1. There are no statistically significant differences at a significant level (0.05) between the mean scores of the experimental group and the control group in the post application of the achievement test as a whole and the cognitive levels separately.
2. There are no statistically significant differences at a significance level (0.05) between the mean scores of the experimental group and the control group in the post application of the test, visual thinking as a whole and skills separately.
3. There are no statistically significant differences at the level of significance (0.05) between the mean scores of the experimental group and the control group in the application of the measure of attitude towards science.

The limits of study:

1. **Human limits:** a sample of fifth grade students in the State of Kuwait.
2. **place limits:** Included are some primary schools in the Ahmadi Educational District.
3. **Temporal limits:** The study was applied in the second semester of the 2019/2020 academic year.

Terminology of study:

- **Infographic:** a technical term that refers to converting complex information and data into pictorial drawings that are easy for those who see them to understand without having to read a lot of texts (Issa, 2014). The researcher knows it: Converting complex and difficult data, information and concepts into pictures and drawings that can be understood and understood clearly and interestingly by presenting them in a smooth, easy and clear manner.
- **Visual Thinking:** a mental capacity directly related to the visual sensory aspects, as this type of thinking occurs when there is mutual coordination

between what the learner sees in terms of shapes, drawings and relationships and what happens in terms of linking and mental outcomes based on the vision and the presented drawing (Afaneh, 2001, 9) The researcher knows it: a mental capacity that uses images, geometric shapes, and charts, explains it, and transforms it from the language of vision and the drawn language into a verbal, spoken or written language, drawing conclusions and meanings, and justifying information in order to communicate with others.

Theoretical framework and previous studies:

Infographic:

Brain research related to the physiology of vision and the ways in which the eye is used to process information provided convincing justifications for the use of infographics in everyday interconnected communications, as scientists at MIT discovered that vision is the largest part of brain physiology, and that approximately (50%) of the brain power is directed in a direct fashion. Direct or indirect towards the function of vision, which confirms that the brain's processing of infographic information is less complex in its processing of raw texts, as the brain deals with images all at once, while it deals with the text in a successive linear manner (Abdel-Basit, 2015).

Infographic is defined as: the art of transforming complex data, information and concepts into images and drawings that can be understood and understood clearly and with suspense. This method is characterized by presenting complex and difficult information in an easy and clear way (Shaltout, 2016, 111).

It is also known as: a set of still or moving images, graphics, stocks and video clips supported in verbal language combined in one design, which provide the learner with the development of visual thinking skills (Darwish and Al-Dakhni, 2015, 279).

The importance of infographics in supporting the teaching and learning processes:

Abdel Basit (2015) indicated that the infographic provides those in charge of the educational process the opportunity to invest the following aspects in supporting the scientific process:

- About (90%) of the information that is transferred to the brain is visual information.
- About 40% of individuals respond better to pictorial information compared to textual information.
- The brain processes pictorial information about (60000) times faster than textual information, due to the fact that the brain deals with the image simultaneously (Simultaneous), while it deals with text in a sequential manner.
- People spend most of their time on pages that contain video files.

Dai (2014) pointed out that the importance of the infographic is represented in the following points:

- The infographic gives the reader a set of clear and easy-to-understand information, and the successful infographic is distinguished by its ease of reading, achieving its goal in delivering the right message to individuals and encouraging more individuals to share it.
- Many benefits can be gained through a distinctive infographic design, as individuals can share it on social networks, and thus collect its content and give priority to global search engines.
- Everyone prefers to see the infographic more than reading an explicit text without any pictures, but by providing these two elements, the information delivery process will be completed in a useful way.

Al-Jerawi (2015) identified two types of infographics as follows:

1. Static infographic: It is a fixed advertisement printed, distributed or published on Internet pages, and the static infographic content explains some information on a specific topic chosen by the owner of the infographic.

2. Animated Infographic: It consists of two types:
   - Shooting a normal video on which data and explanations are placed in an animated graphic form to show some facts and concepts on the video itself, but unfortunately this type is somewhat underused.
   - Designing data, information and explanations in a fully animated manner, and this type requires a lot of creativity and the selection of expressive movements that help in bringing it out in an interesting and enjoyable way, and this type is the most used.

What to consider when designing your infographic:

- Choose one topic for each infographic.
- Choosing the information that can be represented visually.
- Ensure that the information displayed is correct.
- Choose a special title for the topic of the infographic.
- Merging pictures and drawings, simplifying information and avoiding long sentences.
- Choose attractive colors that suit the information presented.
- The cohesion of the basic components through highlighting the relationships and gathering related information and linking it together.
- List and attach a list of information sources (Isa, 2014).

Smiciklas (2015) stated that the criteria for successful infographic design are as follows: visual persuasion, selection of drawings and geometric shapes, criteria for the subject of learning.

Infographic Design Programs:

Zouhi (2014) indicated that there are many programs that help in designing infographics, and among these programs are the following:

- **Adobe lllustrator:** is the first program in designing infographics for designers, due to its extreme flexibility and its ability to give attractive results.

- **Adobe Photoshop:** Photoshop can be used to design infographics, although it will not be as flexible as a Illustrator, as it is primarily an image editing program, but it can be used to display data in beautiful ways as well.
- **Inkscape:** If you prefer to use a free program, Inkscape is an alternate program for Illustrator.
- **Tableau:** It is a free program that works in the Windows system only. It is used to create colorful and unique designs.
- **Adobe Fireworks:** a nice program for designing infographics, but it is very lightweight and beautifully effective. Besides these programs there are sites that help you design infographics and share to generate graphic statistics.
- **Piktochart:** A site specializing in designing and developing infographic designs and is useful for beginners in the world of infographics, and this site is characterized by the drag and drop feature of shapes, with a number of free templates available to start designing infographics.
- **Creately:** An important tool for creating diagrams and diagrams that provides pre-designed templates and diagrams, you just have to add your data to finish your achievement and share it with others.

Visual thinking:

Islam has a keen interest in reason and thinking, and whenever we searched in the Noble Qur'an, we found that it contains many verses related to thinking, and thinking is the finest cognitive process for the individual that distinguishes him from others. Thinking as a cognitive process is considered an essential element in the mental and cognitive construction of learners, and it affects and is affected by the rest of the other cognitive processes such as perception, perception and memory, and affects the emotional, emotional and social aspects of personality (Al-Salloum, 2001, 2).

Thinking is defined as: the process by which the mind organizes its experiences in a new way to solve a problem, so that this process includes the

perception of new relationships between the topics and the elements that the problem includes, then the perception of the relationship between the introductions and the results and the perception of the relationship between cause and effect between the general and the specific and between something known and another unknown. (Mustafa, 2002, 27). He knows that: a mental process that is raised by a problem and aims at an end, and depends on the individual's general mental capacity, and the activity that the individual performs appears when he is faced with a problem that his previous experiences and information do not enable him to find an immediate solution to (Aziz, 2005, 6).

Visual thinking is defined as an individual's skill to visualize and present an idea or information using pictures and graphics rather than the much padding we use in communicating with others (Wileman, 2000). It is defined as: a system of processes that translates the individual's ability to read the visual figure and convert the visual language that this shape carries into a verbal language written or spoken and extract information from it (Mahdi, 2006, 8). He also knows that: the ability of the individual to deal with perceptible materials and distinguish them visually so that he has the ability to perceive spatial relationships, interpret information, analyze it, and explain ambiguity (Al-Shobaki, 2010, 35).

The importance of teaching visual thinking skills:

Visual thinking is characterized by a prominent importance in the life of the learner, as it improves his ability to multiply visions about a specific educational situation or to devise specific solutions to topics. The importance of visual thinking skills is as follows:

- It helps students to look at different issues from the viewpoints of others, evaluate the opinions of others in many situations and judge them accurately.
- It enhances the process of learning and enjoyment, which raises the level of self-confidence and self-esteem of students.

- Freeing students' minds and thinking from the constraints on answering difficult questions, and proposed solutions to the many problems they discuss, and work to solve or alleviate them.
- Familiarity with teamwork among students and stimulating their thinking, increasing their motivation, activity and vitality, and making the teaching process characterized by excitement, participation and cooperation among students.
- It reduces the focus on the dumping of the academic material, because students enjoy the various educational activities through which they can acquire the desired knowledge, skills and attitudes.
- Freeing students' minds and thinking from restrictions, and from getting used to specific answers.
- Familiarize students with accessing information and data that appear at first glance by reading shapes, pictures and graphs.
- Training students to see the internal relationships of the displayed images and drawings, and to discover the relative relationships that may emerge from analyzing the displayed drawings.
- Developing students' ability of accurate observation (Khaznadar et al., 2006, 140-15; Ibrahim, 2011, 109; Zangour, 2013, 63-64).

Visual thinking tools:

The way to represent the visual shapes to the learner in the so-called visual thinking tools, which are as follows:

1. Symbols: They are the most common and used in communication, although they are more abstract.

2. Pictures: It is one of the most accurate methods of communication, but its high cost and difficulty in its continuous availability prevented its frequent use.

3. Diagrams of Shapes: Some students use them to visualize ideas and solutions, and sometimes include:

- Drawings related to pictures: they have objections that are easy to distinguish from an object or an idea, and the use of these objects as pictures of the body in detail using printed or computer scraps.
- Concept-related drawings: bear the same characteristics and characteristics of the concepts to facilitate their distinction if necessary.
- Comics: rely on the learner's imagination as a way to see the relationships between ideas (Zangour, 2013, 64; Davies, 2011, 187; Gulcin, 2010, 259).

Visual thinking skills:

Visual thinking requires a set of necessary skills that must be developed by students using different activities such as reading pictures, shapes and drawings, and understanding the relationships between shapes ... etc., and in light of reviewing the literature related to visual thinking skills such as studying: Elgamal, Kalab (2017), Shobaki (2010), Mahdi, (2006), visual thinking skills can be identified as follows:

- The skill of recognizing the shape and describing it: is the ability to determine the dimensions and nature of the displayed figure.
- Shape analysis skill: the ability to see relationships in the shape and to identify the characteristics of those relationships and classify them.
- The skill of linking relationships in the form: is the ability to relate between the elements of relationships in the form and find correspondences between them and their fallacies.
- The skill of perceiving and explaining ambiguity: it is the ability to clarify the gaps and fallacies in relationships and bring them closer.
- Meaning extraction skill: is the ability to infer new meanings and arrive at scientific concepts and principles.
- Visual communication skill: training the student in it enables him to review his work, and for his mind to monitor and control while performing other visual skills.

- The skill of perceiving spatial relationships: it refers to the ability to recognize the position of objects in space and the difference in their location according to the location of the individual watching them.
- Visual memory skill: preserving visual images to be retrieved at a later time.
- The skill of mental rotation: is the movement of mental images of an object.
- Visual style skill: is the recognition of the sequence of visual phenomena and the recognition of the base on which it is going to be used in solving a problem.

The following is a review of some previous studies related to the subject of the current study:

Elgamal, Kalab (2017) conducted a study aimed at revealing the effectiveness of a science-fiction-based program in developing concepts and visual thinking skills among students of the eighth grade of basic education in Gaza City. The sample consisted of (80) female students and was divided equally into two groups: the experimental group and studied using science fiction and the control group and studied in the normal way, and the study tools included testing scientific concepts and testing visual thinking skills. The study found that the science-fiction-based program achieved more effectiveness than the modified gain factor of Black in terms of developing concepts and visual thinking skills of students.

Ismail's study (2016) aimed to identify the effect of infographic on the development of academic achievement among students of educational technology at the level of remembering, understanding, application, and analysis, and to know the direction of educational technology students towards infographic, and the study followed the experimental approach, and the research sample was chosen by the deliberate method of technology students Education, which numbered (50) students, and were divided equally into two groups: an experimental group that studied using infographic, and a control group that studied using the traditional method, The study tools included an achievement

test, a measure of the trend towards the use of graphic information charts for students. The results showed a difference between the mean scores of the experimental group and the control group students in the post application of the achievement test on the level of memory, understanding, application and achievement as a whole in favor of the experimental group.

The study of Mahmoud and Al-Sayyad (2016) aimed to reveal the effectiveness of different patterns of presenting educational infographics (static - mobile - interactive) in academic achievement and learning efficiency among fifth grade primary school pupils with learning difficulties in mathematics. The study followed the quasi-experimental approach, and the sample consisted of fifth-grade primary students in four schools in Dammam. Data were collected using an achievement test in mathematics, the successive matrix test, and a measure of student behavior evaluation. The results of the study concluded that there are significant differences between the mean scores of the first experimental group that was studied using the computer program based on the fixed infographic pattern and the control group in the post-measurement of the study tools in favor of the first experimental group, and the presence of significant differences between the mean scores of the second experimental group that were studied using the existing computer program The pattern of moving infographics and the control group in the post-measurement of the study tools in favor of the second experimental group, and the existence of significant differences between the mean scores of the students of the third experimental group that were studied using the computer program based on the interactive infographic pattern and the control group in the post-measurement of the study tools in favor of the third experimental group.

Abu Zaid's study (2016) aimed at identifying the effect of using infographics in teaching geography to develop achievement and visual thinking skills among high school students, and the study followed the semi-experimental approach, and the sample consisted of (80) students who were divided equally into two groups: the experimental group and studied using the infographic , And the control group and studied in the traditional way, and the research tools included an achievement test and a visual thinking test. The results showed a

statistically significant difference between the mean scores of the experimental group and the control group students in the post application of the achievement test in favor of the experimental group, and the presence of a statistically significant difference between the mean scores of the experimental group and the control group students in the post application of the visual reasoning test in favor of the experimental group.

The study of Darwish and Al-Dakhni (2015) aimed at identifying the effect of two patterns of presenting infographic (static / moving) via the web on the development of visual thinking skills of autistic children and their attitudes towards it. The study used the experimental approach, and the sample consisted of (30) children of autism, whose ages ranged from (7-10) years were divided equally into two groups: the first experimental group studied using static infographics, and the second experimental group studied using mobile infographics,The research tools included a test of visual thinking skills and a scale of attitudes. The results showed a statistically significant difference between the mean scores of the first experimental group and the second experimental group in the post application of the test of visual thinking skills and the attitude scale in favor of the first experimental group.

Awadallah's study (2015) aimed to know the effect of using infographics on the achievement of fifth-grade students in basic sciences, and on their attitudes and motivation towards learning it in the Salfit governorate. The study used the semi-experimental approach, and the study was applied to a sample of fifth grade students, and they were divided into two groups. One of them is an experimental one that studied the content of the plant unit using infographics, and the other is a control that studied the traditional method, and the study tools included an achievement test, trend scale, motivation scale. The results showed that there were statistically significant differences between the mean scores of the experimental group and the control group in the total score of the post-achievement test, the attitudes scale and the motivation scale in favor of the experimental group. The study recommended the importance of using infographics in teaching science curricula at all educational levels.

The study of Al-Jarawi (2014) aimed at knowing the effectiveness of using a proposed training program in developing the skills of designing electronic mental maps through the technique of infographic and visual culture skills of female teachers before service. Class teacher from the Curriculum Department. The results indicated that the proposed program has contributed to an improvement in the level of knowledge of visual culture skills and technical skills of infographic designs in designing electronic mind maps for learning lessons in the study sample.

Study procedures:

Study Approach:

The current study followed the semi-experimental approach, due to its suitability for the nature of the study.

Study Population and Sample:

The study population consists of all primary school pupils in public education schools in the State of Kuwait, and the study sample consisted of (64) male and female students, which were divided into two groups: The experimental group includes (34) male and female students, and they studied using infographics, the control group includes (30) male and female students and studied The traditional way.

Study tools:

It included an achievement test, a visual thinking test, and an attitude towards science scale, as follows:

1- Achievement Test:

It aims to measure the effect of using infographics in teaching science on the achievement of fifth-grade pupils in primary school in the State of Kuwait in the Physical Sciences Unit. The vocabulary of the achievement test used in the current study is based on a multiple test pattern and measures the following cognitive levels: remembering, understanding, and application. After completing the development of the test items, the researcher formulated the test instructions, and the test in its initial form consisted of (30) items.

Validity:

A- Validate the content:

The test was presented to a group of specialists in the field of curricula and methods of teaching science, and the judges agreed to amend the language wording of some items, and they were amended according to their opinions, and the arbitrators 'agreement is considered a statement of the veracity of the test content.

B- Empirical honesty:

The peripheral comparison method was used to measure the experimental validity of the test, and it is based on the idea of comparing the averages of the high and low scores, then calculating the significance of the difference between the two averages, as it is possible to reassure the validity of the test whenever the difference between the two averages has a clear statistical significance, and this is explained in the following table.

Table (1)

Results related to the validity of the achievement test

Group	No. of pupils	Mean	standard deviation	t	Sig.
1	10	24.8	1.097	10.478	0.0001
2	10	10.3	3.495		

The two ends of the high and low scores were determined by taking (27%) from the upper section of the grades, and (27%) from the lower part of the scores after being ranked in descending order, and the value of (T) was (10.478). The level of its significance is (0.0001), so the difference between the two averages is real and does not refer to the chance factor, and thus the validity of the test is achieved in measuring what was set for it.

C- Validity of internal consistency:

The validity of the internal consistency of the achievement test was verified by calculating the correlation coefficient between the scores of each

cognitive level of the achievement test cognitive levels and the overall test score obtained from the exploratory study, as shown in the following table.

Table (2)

Correlation coefficients between each level of knowledge and the overall score of the achievement test

Cognitive level	Correlation coefficient
Memory	0.80**
Understanding	0.82**
Application	0.81**

(**) significance at level (0.01)

It is evident from the previous table that the coefficients for consistency of cognitive levels of the achievement test with the total score of the test ranged between (0.80 - 0.82), and all of them are statistically significant at the level of significance (0.01), which indicates the validity of the internal consistency of the test.

Reliability:

The test reliability coefficient was calculated by half segmentation, where the correlation coefficient was calculated using the Pearson Correlation coefficient and amounted to (0.835). This is an indication that the test is on a high degree of stability, and then the results obtained can be trusted and reassured when applying On the basic study sample. The test in its final form consists of (30) items, and the answer time for the test is (45) minutes.

2- Visual Thinking Test:

It aims to measure visual thinking skills in science for fifth grade students in the State of Kuwait. The test used in the current study was limited to the following skills: shape recognition, ambiguity interpretation, meaning extraction, visual discrimination. The vocabulary of visual thinking in the sciences was prepared in light of the previous skills, and the test included in its initial form (19) items. Instructions addressed to students were prepared and placed in the question booklet for their review before starting to answer.

Validity:

A- Validate the content:

The test was presented to a group of specialists in the field of curricula and methods of teaching science, and the judges agreed to amend the language wording of some items and delete three items.

B- Validity of internal consistency:

This was confirmed by calculating the correlation coefficient between the scores of each skill and the total score of the test obtained from the exploratory study, and it is shown in the following table.

Table (3)

Correlation coefficients between each level of knowledge and the overall score of the achievement test.

Skill	Correlation coefficient
Know the shape	0.84**
Interpretation of ambiguities	0.77**
Extraction of meanings	0.89**
Visual discrimination	0.74**

(**) significance at level (0.01)

It is evident from the previous table that the correlation coefficients between each skill and the overall score of the visual reasoning test ranged between (0.74 - 0.89), and all of them are statistically significant at the level of significance (0.01), which indicates the validity of the internal consistency of the test.

Reliability:

The test reliability was calculated using the re-application method, and it was found that the test reliability factor was (0.89), which indicates that the test has high stability, and then the results obtained when applied to the basic study sample can be trusted. And the test in its final form consists of (16) items and the answer time for the test is 45 minutes.

3- The trend towards science scale:

It aims to measure the attitudes of fifth grade pupils of elementary school in the State of Kuwait towards the subject of science, and in its initial form it consists of (25) statements, and each statement has five levels of response according to the five-point Likert scale as follows: Strongly agree (5 degrees), agree (4 degrees), neutral (3 marks), disagree (two marks), strongly disagree (one score).

Validity:

A- Validate the content:

The test was presented to a group of arbitrators, and it was modified according to the referees 'proposals. The linguistic wording of some phrases was modified, and the arbitrators' agreement is considered a statement of the validity of the content of the scale.

B- Empirical honesty:

The terminal comparison method was used to measure the experimental validity of the scale, and the following table illustrates it.

Table (4)

Results related to the validity of the measure of attitude towards science

Group	No. of pupils	Mean	Std. deviation	t	Sig.
1	10	74.9	4.15	15.47	0.0001
2	10	48.2	6.21		

The two ends of the high and low scores were determined by taking (27%) from the upper section of the grades, and (27%) from the lower section of the scores after being ranked in descending order, and the value of (T) was (10.478). The level of its significance is (0.0001), so the difference between the two averages is real and does not refer to the chance factor, and thus the validity of the test is achieved in measuring what was set for it.

Reliability:

The reliability of the scale was calculated by using the method of re-application, and it was found that the reliability coefficient of the scale is (0.86), which indicates that the test has high stability, and the scale in its final form consists of (25) words and the answer time for the scale is 40 minutes.

Organizing the content of the Physical Sciences Unit using Infographics:

The content of the Physical Sciences Unit was organized using infographics to suit fifth grade pupils, and it was presented to a group of judges to ensure its suitability to achieve the objectives of the study.

Statistical treatment:

The data were entered by computer through the Statistical Package for Social Sciences (SPSS), and the following statistical treatments were performed to test the validity of the study hypotheses:

- Mean.
- Standard Deviation.
- T Test.

Study results and discussion

This part deals with presenting the findings of the study after the statistical analysis of the data, and to verify the study hypotheses, the responses of the study sample individuals were counted and statistically treated using the SPSS statistical package, and the following is the presentation of these results:

Results of the first hypothesis:

This hypothesis states the following: “There are no statistically significant differences at a significance level (0.05) between the mean scores of the experimental group and the control group in the post application of the achievement test as a whole and the cognitive levels separately.” To test the validity of the first hypothesis, the t-test was used and computed the arithmetic means and standard deviations of the data obtained after applying the post-achievement test to the study sample, and the results were observed in the following table.

Table (5)

(T) test results to test the differences between the mean scores of the control experimental group in the post application of the achievement test

Cognitive level	Group	No.	Mean	Std. deviation	df	t	Sig.
Memory	experimental	34	12.35	1.39	62	5.52	0.0001
	control	30	9.93	2.08			
Understanding	experimental	34	6.35	.60	62	8.17	0.0001
	control	30	3.73	1.76			
Application	experimental	34	6.65	0.98	62	10.14	0.0001
	control	30	3.73	1.31			
The whole test	experimental	34	25.35	1.59	62	12.52	0.0001
	control	30	17.40	3.30			

It is evident from the previous table that there are statistically significant differences at the level of significance (0.05) between the mean scores of the experimental group and the control group in the post application of the achievement test as a whole and the cognitive levels separately (remembering - understanding - application) in favor of the experimental group, where the values of "T" ranged Between (5.52 - 12.52) and its level of significance is less than the level of significance (0.05). This is due to the effect of the infographic in raising the level of achievement as a whole and the cognitive levels separately among the students of the experimental group.

This was reflected in a significant increase in the level of achievement among the experimental group pupils compared with the control group. This result is consistent with many studies that have reached the effect of using infographics on developing student achievement, such as: Abd al-Samad (2017), Hassouna (2017), Ismail (2016), Awad Allah (2015). From the previous results, we reject the zero hypothesis and accept the alternative hypothesis, and thus the text of the first hypothesis is as follows: “There are statistically significant differences at a significance level (0.05) between the mean scores of the

experimental group and the control group in the post application of the achievement test as a whole and the cognitive levels separately."

The results of the second hypothesis:

This hypothesis states the following: "There are no statistically significant differences at a significance level (0.05) between the mean scores of the experimental group and the control group in the post application to test visual thinking as a whole and skills separately." And to test the validity of the second hypothesis, a t-test was used, and the results are shown in the following table.

Table (6)

Results of (T) test to test the differences between the mean scores of the experimental and control group in the post application of the visual reasoning test

Cognitive level	Group	No.	Mean	Std. deviation	df	t	Sig.
Know the shape	experimental	34	2.59	0.50	62	7.59	0.0001
	control	30	1.20	0.92			
Interpretation of ambiguities	experimental	34	3.59	0.50	62	5.90	0.0001
	control	30	2.47	0.97			
Extraction of meanings	experimental	34	5.06	0.74	62	10.10	0.0001
	control	30	2.93	0.94			
Visual discrimination	experimental	34	2.71	0.46	62	5.68	0.0001
	control	30	1.73	0.87			
The whole test	experimental	34	13.94	1.28	62	11.66	0.0001
	control	30	8.33	2.45			

It is evident from the previous table that there are statistically significant differences at a level of significance (0.05) between the mean scores of the experimental group and the control group in the post application of the visual reasoning test as a whole and the skills separately (know form - interpretation of

ambiguity - extracting meanings - visual discrimination) in favor of the experimental group. Where the values of "t" ranged between (5.68-11.66) and the level of its significance is less than the level of significance (0.05). This is due to the effect of the infographic on developing visual thinking skills among the experimental group students. Where the infographic helped increase the abilities of the experimental group pupils to determine the dimensions and nature of the presented figure, increase their ability to see the relationships in the form, determine the characteristics of these relationships and classify them, link the elements of the relationships in the form and find compatibility between them and fallacies in them, in addition to their ability to clarify the gaps and fallacies in the relationships And bring them closer together, and deduce new meanings and come to scientific concepts and principles.

This was reflected in the development of visual thinking skills to a large degree among the experimental group students compared with the control group students. This result is consistent with many studies that have reached the effect of using infographic on developing student achievement, such as: Abu Zaid (2016), Darwish and Al-Dakhni (2015). From the previous results, we reject the zero hypothesis and accept the alternative hypothesis. Thus, the text of the second hypothesis is as follows: “There are statistically significant differences at a significance level (0.05) between the mean scores of the experimental group and the control group in the post application of the visual thinking test as a whole and the skills separately.”

Results of the third hypothesis:

This hypothesis states the following: “There are no statistically significant differences at the level of significance (0.05) between the mean scores of the experimental group and the control group in the post application of the measure of attitude towards science.” And to test the validity of the third hypothesis, a t-test was used, and the results are shown in the following table.

Table (7)

Results of (T) test to test the differences between the mean scores of the experimental and control group in the post application of the Scale of Attitude Towards Science

Group	No. of pupils	Mean	Std. deviation	df	t	Sig.
experimental	34	92.71	9.80	62	8.27	0.0001
control	30	76.67	4.36			

It is evident from the previous table that there are statistically significant differences at the level of significance (0.05) between the mean scores of the experimental group and the control group in the post application of the measure of attitude towards science in favor of the experimental group, where the value of "t" reached (8.27) and its level of significance (0.0001).

It is evident from the results of the current study that there are statistically significant differences between the mean scores of the experimental group and the control group in the post application of the measure of attitude towards science in favor of the experimental group, and this is due to the effect of infographic in forming positive attitudes among the experimental group students towards science learning, as the drawings contributed to Enabling pupils to access and assimilate information quickly, and link it to their previous knowledge, in addition to increasing their motivation towards learning science. This was reflected in the increase in the attitudes of the experimental group students towards science in comparison with the control group students.

This result is consistent with many studies that have found the effect of using infographics on developing the attitude of students, such as the study of: Ismail (2016), Awad Allah (2015), Darwish and Al-Dakhni (2015). From the previous results, we reject the zero hypothesis and accept the alternative hypothesis. Thus, the text of the third hypothesis is as follows: "There are statistically significant differences at a significance level (0.05) between the mean scores of the experimental group and the control group in the post application of the measure of orientation towards science."

Recommendations:

Based on the findings of the current study, the researcher recommends the following:

- Paying attention to developing students' visual thinking skills through the use of infographics.
- Preparing training courses and workshops for science teachers to learn how to use infographic design techniques in planning lessons.
- Reorganizing the content of science books at the elementary level according to the infographic.
- Preparing guides for science teachers in the elementary level to help in teaching science using infographics.
- Infographic is adopted by teachers and mentors as one of the effective strategies in science education.
- Directing the attention of those in charge of science education to the importance of using infographics and its role in the educational process.

Suggested researchs:

As an extension of the findings of the current study, the researcher suggests the possibility of conducting the following studies:

- Conducting a study on the effect of using infographics on developing achievement, visual thinking skills, and orientation towards the subject with other samples that differ from the current study sample.
- Conducting other studies and research to demonstrate the effectiveness of using infographics in teaching other subjects such as chemistry, biology and mathematics.
- Conducting a study on the effect of using infographics on achieving other goals in the sciences with other samples that differ from the current study sample.

- Conducting other studies and research to demonstrate the effectiveness of using infographic in teaching for people with special needs.
- Conducting studies on the effectiveness of other methods for developing students' visual thinking skills in the subject of science with other samples that differ from the current study sample.

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