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# Effect of visual cues associated with hyper links on academic achievement of science for six- grade students

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# ABSTRACT

This paper is a report on the findings of a study conducted on seventh-grade science course. Experimental techniques were used to examine the resulting of utilizing visual cues in a web-based learning environment. Findings indicate that there were no statistically significant differences at the significance level (0.05) between the mean scores of the science achievement test of the first experimental group (which uses the web site with visual cues associated with hyperlinks) and the second experimental group (which uses the web site without visual cues associated with hyperlinks). However, there were statistically significant differences between the mean scores of the pre and post applications of the science achievement test of the first experimental group in favor of the post application. Also, there were statistically significant differences between the mean scores of the second experimental group in favor of the post applications of the post applications.

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## Introduction

Education is in continuous interaction and development. The learner is no longer a negative recipient of information as a result of the emergence of technological innovations and their utilization in the field of instruction. It was thrown on himself the responsibility for learning. This has necessitated that the learner should be active during the learning situations, discuss, search, deal with printed and non-print instructional materials, and interact with them.

Education has continued to progress and develop, which has contributed to the production of modern technological media and methods to keep pace with the changes of every era and to allow adjustment with these changes. Thus, instruction turns from passive memorization and coaching to positive understanding, persuasion, innovation, search for information, and composition of self-experience through the instructional process and connecting instruction with application.

Technological media would be interactive when they provide the user with control and freedom in the presentation and selection of information he/she needs. Moreover, they could be hyper when they are supplied within the content with links to connect the elements, thus the user can navigate through the program [1].

Hypermedia systems has presented many solutions for some instructional problems and enhanced learning environment as it increases the interaction between the learners and the content, and addresses the individual differences by meeting the learners' needs during carrying out the learning activities appropriate to their needs [2].

Hypermedia contains hypertext inside them, so it is considered a major component of hypermedia as they combine between hypertext structure and multimedia and connect between them in a hyper way. Thus, hypermedia has the advantages and properties of hypertext and multimedia [3]

Hypermedia systems consist of three main elements: (a) a data base that contains information and called nodes, (b)

navigation tools to navigate between nodes, and (c) hyperlinks that connect among information nodes [4]. Hyperlinks facilitate the navigation within the program, help the learner determine the information sequence he wants, recognize the relations between the program elements, modify his path to follow the educational process when he encountered obstacles [5].

There are many factors that affect the effectiveness of hyperlinks and thus the effectiveness of the instructional program such as the linking objects, the objective of linking, density of links, and visual cues associated with the hyperlinks [6].

According to cues summation theory of Hartman, learning increases when the number of stimuli increases, if these stimuli are linked together and complement each other. Moreover, multiple learning styles and the diversity of stimuli that address learner's different senses attract his attention and direct him towards the thing to be learned. These stimuli are called cues. These cues can be presented through many methods, such as audio cues which include sounds, music and audio effects, and visual cues which include colors, animation, lines, arrows, and other visual effects [7].

Learning of concepts requires using visual and non visual cues to guide the learner's attention to the common property of the concept he/she learned [8]. The agreement between the Cues Summation theory and Dual Coding theory as information can be coded verbally and visually to be received through two channels: the first processes the verbal information, and the second processes the visual (graphic) information. The functional and effective combination of information processing through both channels activates the coding system of the learner, improves learning, and activates mental processes in different ways [4].

## **Research Problem:**

Recent years have witnessed great projects and efforts to develop science teaching. Conferences and seminars were held at the Arab and international levels and they show that science





teaching is still unable to track the scientific developments and the modern trends of instruction and learning processes. Therefore, scientific and organized work to raise the efficiency of science and its teaching is necessary to make it consistent with the nature of the age and its requirements.

Moreover, interviews with some science teachers showed that science teaching faces some obstacles including density of the number of students in the classroom, individual differences between students, lack of equipments of science laboratories, and difficulty of demonstration. Seventh-grade science content includes pictures, graphics, and instructional models that are difficult to be presented through the traditional method of teaching. Therefore, designing an instructional web site will help in solving many of these teaching problems.

Many previous studies have agreed on the importance of visual cues such as [4][7][9].

The research main question is determined as follows: What is the effect of visual cues associated with hyperlinks on science achievement for seventh-grade students?

This research aims at revealing the effect of visual cues associated with hyperlinks on science achievement for seventhgrade students.

# Significance:

This research adds to the existing literature through identifying the suitable visual cues for hypermedia programs, introducing a conceptual framework that achieves the objectives of science course for seventh-grade, and providing educators with a model of an instructional web site based on hypermedia so that they can enhance the effectiveness of online learning and create an interactive learning environment suitable for learning science for seventh-grade students.

#### Literature Review:

This part deals with the presentation of literature associated with the research variables in terms of hypermedia concept, elements of hypermedia, hypermedia structure, and characteristics of hypermedia programs in the instructional process and visual cues.

# Hypermedia:

Hypermedia programs are one the most important approaches based on using computers in instruction at the moment, and hypermedia is considered as a natural extension of hypertext, and similar to it, except that they contain other elements in addition to texts such as: video, graphics, images, sounds, and other elements.

According to many of the literature, some use the terms hypermedia, hypertext, and multimedia as synonyms, where they argue that there is no essential difference between those terms, and it can be said that although there are similarities between hypermedia, hypertext and multimedia, there are many differences between them [10]. Therefore, multimedia can be used with different means, including computer programs, while hypermedia programs depend on computer use only [11].

Hypermedia is a new technology in the field of instruction and learning that provides the learner with gradual integration with the inputs of instructional media through computers. They also provide the learner with an educational tutorial environment which contains an integrated unit of information derived from multiple sources to be in the format of one system. This system includes various types of instructional media such as audio recordings, animation, or video clips, etc., all aimed at helping the learner to achieve clear objectives previously identified [12].

Moreover, hypermedia provide a varied learning environment where each learner can find what suits him and this can be done procedurally by providing the learner with a range of options and alternatives and teaching aids including all elements of information: texts, graphics, pictures, animation, and video clips, as well as various instructional activities in the hypermedia program. This diversity is working on the development of mental and explanatory abilities of the learner as it makes the learner awake, active, and responsive to the instructional situation, as he finds what suits him and meets his needs [13].

# Hypermedia Concept:

The emergence of developed generations of computers concerning their mechanisms, technology, and constantly evolving capabilities resulted in the term hypermedia to reflect the presentation of ideas and information through the connection between any of the written texts and graphics, images, and choosing the items suitable for the learner to interact with.

Hypermedia has been defined as "an instructional programming environment that helps connect between information elements in non-linear forms to help the learner to navigate and interact with them in order to achieve the required instructional objectives and meet his educational needs [14]. Hypermedia is defined as a learning environment based on the computer, and it consists of nodes and links through which information is displayed comprehensively, and deeply, in addition to the integration between various media such as graphics, pictures, sounds, and videos as well as texts [10]. Hypermedia is a term that includes a system of hypertext in addition to other media such as graphics, animation, video, and audio. It is based on the links, and the link may be part of the text or part of any other medium [15]. Hypermedia is also defined as an extension of hypertext, it makes integration of graphics, animation, sound and image with text, and provides information through nodes referred to as cards in the programs such as hyper card, super card, and hyper studio [16]. These nodes are linked together in the form of a network. Hypermedia is a system that depends on the linking of information, and displaying it as a network including multimedia elements such as graphics, texts, sounds and animation [17].

Based on the previous definitions, it is clear that hypermedia is an extension of hypertext in addition to containing other media such as video, graphics, sounds, and other media. Also, it relies on the idea of nodes and links, whether in the form of text or other forms, allowing the learner to discover content in an interactive integrated way.

# Hypermedia elements:

Hypertext: It is the simplest form of hypermedia elements, where the text is processed with certain specifications in order to achieve the desired educational goal, and this text can lead to text, graphics, or sounds through the nodes and the links between the text and the other elements [18].

Hyper images: The images are considered one of the important elements that have an important role in hypermedia programs, where they convey the content of the message to learners easily. It was developed to become hyper pictures, through the application of what is happening in hypertexts fragmentation of information and connecting between it with links, which can be branching through any image to another image to give more clarifications on the content of the first image or add new information to them, or presenting more details about the first image [19].

Audio: Audio is a key element in hypermedia programs, and it is one of the more used components of hypermedia use after texts and images. It has a special nature, as the learner can notice its presence in the program quickly and easily, which may affect the learner's motivation to continue the program. Also, the nature of sound, its type and quality affect consisted of the learner's acceptance of the program. Due to the importance of this element in the instructional program, it has been developed to link between a set of nodes that contain a set of sounds, voice comment on a particular subject, or sound effects to achieve the required objectives, Navigation between the nodes is similar to the navigation in hypertext.

The sound is divided into two types:

(a) Audio commentary:

It is a human sound that accompanies the presentation of programs or part of it on the computer screen, or the sound used to give directions and guidance to the user or explanation of some information in plain language [20].

(b) Music and sound effects:

They are musical sounds accompanying visual stimuli that appear on the screen and include natural sounds, artificial sounds, and music. Sound effects are any sound issued by the machine to simulate another realistic sound such as sounds of wind, rain and a heartbeat. They can be used in the reinforcement and the transition from one screen to another or when you press a particular key [21].

# Hyper Video:

It appears in the form of animated movie clips recorded digitally. Video is considered one of the important elements of hypermedia technology, as it gives the learner a pleasure to watch, and it can convey the scientific message accurately including experiences and skills in an effective manner [22]. Video becomes a hyper element when synchronization and linking between video sequences are made to appear on the same screen or on sequenced times to display specific steps, or to get more details of a particular idea. These video clips are organized in segments connected with each other by links to help in navigation [23].

# Hypermedia Structure:

Hypermedia is a computer program that consists of several pages or nodes Each page includes a set of elements (text, audio, image, video clips, snapshots, and virtual reality), and these pages or nodes are linked with each other through links. And the learner can navigate between the pages in a non-linear manner clicking on these links that may be an image, text, or an item on the screen [4].

Hypermedia should have components to implement the required functions as follows:

#### Database:

Hypermedia database is made up of elements or separate information units. These units provide information through multiple forms and different stimuli such as video clips, images, text, still and moving graphics and sound. Information is presented in coherent and effective ways and methods of control [19].

#### Nodes:

Nodes are the building unit of hypermedia. A hypermedia program consists of several pages, each containing a number of instructional aids that are associated with other elements or other pages. Each item is specified as one of the words that, can be linked to several other elements called a Node. When we refer to this word and click with the mouse, it may offer a definition of this word, or take us to another page containing other wider issues [24].

These nodes work as workstation combining the database, and each node is considered an integrated small information unit based on the link between the other nodes that made up the largest single entity and the most comprehensive in the amount of information, items, and media they contain. There is no limit to the size of the node. Each node may contain a single word, a full article, a picture, instructional graphic or video clips [19]. **Hyperlinks:** 

They represent the logical relationships between the learning content. Hypermedia deal with knowledge in the form of a network of learning tasks, so the design of links depends on the results of analysis of learning tasks. When designing the links, we should take into account the learner's learning method. These links appear in the program in a special form such as a word with different color, underlined word, a word surrounded by a box, icons, or lists. It is necessary to take into account that not every program that contains these links is a hypermedia program because it is necessary to provide a number of basic conditions in such programs as follows:

- Providing a database of information.

- Multiple ways of navigation including hyperlinks.

- Using a large number of media such as texts, still and animated graphics, and video to display information [25].

Hyperlinks are considered a means of connection and communication between different nodes in the program. They facilitate the transition process and navigation between these nodes freely and easily. These links connect between two joint stations: the first station is called the beginning or source, and the second station is called terminal or target. This system enables the user to move between stations using the links specified by the designer. The links may be words, phrases, icons, still or animated images, windows, or anything else that can be chosen by clicking the mouse, and the link remains dormant until activated by the mouse to move to the new node. So we can say that the links help the learner to determine the sequence of information he desires, and move from one place to another, navigate in the program easily, and understand the relations between the elements of the concept [19].

#### **Methods and Media:**

Methods and paths in the program are determined by the designer. They are varied and complex and serve as the prospects for the learner's path in the program. The designer puts a wide range of methods and tracks where the learner may navigate in the whole program, or take a specific path that suits his needs and experience. Thus, hypermedia technique gives the learner an opportunity to make his own learning, as opposed to linear systems that do not allow learners to innovate their own ways of learning [19].

# Networks of ideas:

Ideas networks are built by nodes and links, and through connecting distributed links with each other. When the nodes are interconnected together, they form methods and tracks, and when these methods and tracks are linked together, they form a large network of information and resources, which is similar to compositional information organizing in human memory, and this similarity leads to a good understanding of the problem or information contained in the system. This information is distributed in the brain on a group of nerves nodes. The network system of ideas in hypermedia programs is similar to this system, but it is an artificial network, it can also increase these nodes and provide tools for the inference to seize knowledge to enter the scope of artificial intelligence systems. Thus, hypermedia systems can be considered a nucleus of artificial intelligence systems or within its components [19].

# Methods and patterns of navigation:

Navigation in hypermedia programs includes tools that can be used by the learner to know where he is, where to go, and how it goes. Navigation means the tools by which the user can detect and control the elements of graphics, text, sound, and video in hypermedia programs [26].

Navigation tools can be used by learners to find out where they are, where they are going, and how they reach there. Moreover, they help the learner to move within programs in a way that qualifies him to gain as much of knowledge, such as being able to move to page 10 and return the first page or choose what he wants to do by changing the scientific level or exit the program [16].

# Characteristics of hypermedia programs in the instructional process:

The benefits of hypermedia in the educational process are as follows [27]:

• Suitability for storage and use of information, as it can compress the information, which increases the efficiency to store information and its usability, and that what gives hypermedia a great importance in the management and guidance of the content and control of the learning process.

• It is a tool for open thinking: cognitive structure of hypermedia programs develops the learner's logical thinking, which is the basis for problem-solving skills and innovative thinking.

• Individualism: In hypermedia programs, learners determine their own goals according to their previous experience, skills and personal characteristics. In the process of learning, it is the learner who takes decision not the program. The program does not control the learning process, but provides an appropriate learning environment.

• Effective study of the teaching process: Hypermedia program offers an active medium for analyzing the process of teaching, and getting useful information about the learning goals, the subject matter, and the interrelationships among the subjects, i.e. we can compose a complete idea about the learning process.

They also offer a set of mechanisms to improve the installations of information, through the learner's transfer and presentation of information, and then update the links related to that information in a manner leading to static learning [12].

Hypermedia programs provide learners with an integrated system including audio, pictures, animation, colors, verbal and visual texts, in addition to the possibility of entering, skipping, modifying, and navigating freely through the information. It is also a training tool, as it is used to train students to master and acquire instructional skills, or various science skills, which are displayed in different methods [10].

Studies and research related to hypermedia programs are numerous. They dealt with various variables such as achievement, skills and attitudes towards courses and other variables.

A study aimed to use hypermedia programs as a framework for teaching science, and provide a teaching method that helps to explore and classify information. The study results showed the presence of statistically significant differences in students' acquisition of concepts, and the effectiveness of the program in achieving all the learning objectives that have been identified in the program [28]. Another study discussed the use of hypermedia as an instructional tool, and the role of these programs in the success of the learning process. The results of this study revealed that learner's characteristics have a role in the achievement through hypermedia environment. This study focused on both the cognitive beliefs of the student and his self pacing [29].

A recent study aimed at identifying the effectiveness of using hypermedia programs in developing students' achievement, and acquiring self-regulation skills at the stage of university education. The findings suggested that there are significant differences in favor of groups that have studied through hypermedia program regardless of the way of presenting the content whether linear or nonlinear [30].

A study tried to identify the impact of the interaction between the cognitive style and strategies of instruction such as advanced organizers and concept maps in a hypermedia program on the students' achievement and performance. The most important findings of the study showed that the level of independent students was better than the cognitive level of dependent students in the cognitive achievement [31].

Another study aimed to identify the impact of an instructional design based on hypermedia according to Ausuble's model for advanced organizers on the achievement of female student-teachers. The results of the study showed the effectiveness of the hypermedia program in enhancing achievement [32].

A more recent discussed which types of technology used as a learning environment can have more effect in achievement. It reviewed (48) studies related to hypermedia and hypertext, and discussed how the learning style affects achievement when the learner uses these programs. The results of the analysis of these studies showed that the students interact with the programs differently and that they were investigating greater achievement when they use a learning environment based on hypermedia programs. Moreover, achievement and interaction with such programs depend on the learning style of the student [33].

Another study aimed to design hypermedia program to train student teachers on developing mathematical thinking skills for children. The study sample consisted of (24) student teachers divided into two groups: (a) group I studied by using hypermedia program designed in the form of separate modules including multiple methods of navigation, (b) group II studied by using hypermedia program designed in the form of a long story. The results of the study showed that the two groups have made a gain in declarative knowledge in mathematical measurements, and confirmed also that students who used the modules system have the ability to think logically greater than the second group [34].

Another study examined the impact of using metaphors, concept maps, and individual differences in navigation via the internet. The study confirmed that the nature of hypermedia programs allows meeting the individual needs, because they contain a large number of navigation methods. The results showed that the problems of unguided navigation can be solved if the user identified the structure of the hypermedia program through adding cues and hints in the program. The results showed also that cognitive styles can affect the cognitive abilities of the learner, so the study emphasized the need to take account of these styles when developing hypermedia programs [35].

Another study aimed at discussing the impact of cognitive styles in hypermedia program on the achievement. The study results have shown the need to include cognitive styles when designing hypermedia programs [36].

Another study aimed at identifying the effectiveness of different methods of content sequencing (expansion-constructivism), and the presentation patterns (individual - small groups) in the design of hypermedia programs on achievement, critical thinking, and values of a suggested unit in bioinformatics for students at the Faculty of Education. The study results showed that there were statistically significant differences at the level of (0.05) between the mean scores of students' gain in the achievement test, as well as on the scale of

values, and the critical thinking test due to the impact of the pattern of content sequence (expansion - constructivism) [37]. **Visual Cues:** 

Many physiological studies showed that visual cues control the response of the viewer while watching the visual content, and that the affective sense depends more on the visual cues and the lack of visual information is not recommended. The viewer might seek behind the level of arousal that increases his motivation towards the visual content displayed [38].

There are various hint techniques such as audio cues (sounds and music), and visual cues (colors, animation, lines, arrows, visual effects, etc.). The learner can be guided to the things to be learned by using the arrows, animation, color, graphics, lines, and using circles, and frames, and other visual materials [39].

For example, the color is an important visual component in the instructional presentations if utilized properly, and the color functions in the instructional pictures and graphics are to focus on the important elements of the learning topic, and to identify similarities and differences between them, or to focus attention on the original stimuli [40].

#### Visual cues concept:

Visual cues have been identified as a sign or a secondary stimulus in the perceptive domain that helps to bring about discrimination or the right response [41]. Visual cues are signs and implications requiring signals to represent the content. They may be digital signals such as using words and numbers, and they may be visual icons when using forms, graphics, and images with color or shading in order to attract the learner's attention and increase his awareness of certain parts [42].

Cues are clear or hidden secondary stimuli and they are not part of the scientific content. They help the learner to do some cognitive processes, such as focusing attention on the original stimulus, comparison, connectivity, interpretation, analysis and forecasting in order to make the right response [43]. Visual cues are also defined as stimuli that address the learner's senses, and attract his attention towards the thing to be learned such as colors, animation, lines, arrows and visual effects, etc [44].

Dual Coding theory of Paivio assumes the presence of two folds: one specialized in the treatment of verbal stimuli and the other specialized in dealing with visible stimuli. According to the theory of Dual Coding, information is presented through two channels instead of only one working as a double dose, which enhances the ability of storing information [45]. In the light of dual coding theory, learning occurs through visual templates when the viewer uses the information provided through two forms: visual in the form of images, and verbal in the form of narration to compose knowledge. The theory describes how to integrate visual materials presented in the verbal working memory of the learner during learning. In the top left part of the figure verbal interpretation is presented to the learner [46].

The other theory is Cue-Summation Theory, which says that when you provide verbal information as well as images, they provide additional instructional hints or signs especially at the time of retrieval from memory. There are many signs in the research on the field of animation that the addition of visual stimuli or visual cues promotes memorizing the visual content presented [45].

The idea underlying this theory has been developed and applied to the synonymy between audio and visual stimuli. Processing information in order to understand or remember it occurs at a higher level if there is a kind of synonymy between verbal and visual stimuli. According to the theory CueSummation, the increase of the number of stimuli in video and television programs lead to increased information obtained by the receiver, which helps in the process of understanding. The synonymy between audio and video stimuli also can facilitate the process of information processing, reduces the errors, and increases the recipient's attention degree to the visual content displayed, and the ability to retain and transfer information to the long-term memory [47].

# **Types of Cues:**

Visual cues have been divided into two types: Salience Visual Stimuli and Non-Salience Visual Stimuli, and believes that these stimuli affect the attention in two aspects: attract attention and keep it as a result of their cognitive prominent, distinguish between important and unimportant content, and provide an appropriate pattern to encode the content in the form of symbolism. They also have two functions: the first Salience, and the second Orienting [48].

# The importance of visual cues in the learning process:

Visual Cues have an important place in the presentation of visual content as they attract the learner's attention and increase his understanding to what is presented. They are used to clarify ideas and change abstract ideas to concrete ones, in addition to their educational and psychological importance as learners need multiple learning stimuli to use their senses effectively to complete experience [49].

A Cue has two functions: first, it refers to the important part of the visual content, which enhances the cognitive structure provided, and second, it contributes to the presentation of visual information in points can be understood effectively within the visual structure provided [50].

# **Research Hypotheses:**

Results of previous studies, alongside the literature review, were employed to develop the following hypotheses:

 $H_1$ : There is a statistically significant difference at the significance level (0.05) between the mean scores of the science achievement test of the first experimental group (which uses the web site with visual cues associated with hyperlinks) and the second experimental group (which uses the web site without visual cues associated with hyperlinks) in favor of the first experimental group.

H<sub>1</sub>: There is a statistically significant difference at the significance level (0.05) between the mean scores of the pre and the post application of the science achievement test of the first experimental group (which uses the web site with visual cues associated with hyperlinks) in favor of the post application.

 $H_1$ : There is a statistically significant difference at the significance level (0.05) between the mean scores of the pre and the post application of the science achievement test of the second experimental group (which uses the website without visual cues associated with hyperlinks) in favor of the post application.

#### **Research Method**

The researcher has used the experimental method to detect the effect of visual cues utilized in an instructional website based on hypermedia in science achievement for sixth grade students. A pretest-posttest two group design has been used. The research sample consisted of (30) seventh-grade students randomly selected and divided into two equal experimental groups.

This research included the following variables: (a) Independent variable: visual cues associated with hyperlinks (written texts), (b) Dependent variable: Academic achievement of science. The research tool is a verbal/visual objective test.

Instructional design is considered the basis of developing the instructional programs in general and hypermedia programs in particular, as it focuses on the learners' needs through the identification of their previous experience and what they need to know now. Moreover, it helps to create conditions that facilitate learning, and analyze learning outcomes in form of goals and objectives that can be measured. Recently, researchers have developed some instructional design models to be used to design hypermedia programs. These ISD models are based on learning and communication theories, and behavioral and cognitive sciences [51][52][53][4]. After reviewing some Arabic & foreign models for designing hypermedia programs, the researcher has followed the ISD model of Khamis (2003), as it is considered a comprehensive model that contains five basic stages: analysis, design, development, summative evaluation, and publishing, use & revision stages. Each stage includes a set of sequential procedures, and is related to formative evaluation and feedback which helps the process of amendment and revision and continuous improvement. Fig. (1) shows the stages of Khamis' ISD model [4].



# Figure 1: The stages of Khamis' ISD model (2003). Design of study tool

For the purpose of this study, an achievement test was developed. The final version of the test included 20 multiple choice items to measure all the instructional objectives included in the unit of "Matter forms" for seventh-grade students in Saqr Quraish preparatory school. The researcher has determined the instructions of the test clearly in a separate page at the beginning of the test booklet. Each correct answer = 1, and each wrong answer =0.

#### Validity and Reliability

The achievement test validity was based on the opinion of five experts in the field of e-learning, besides piloting the achievement test on a sample of 15 six grade students at the same school in Jeddah. Feedback led to changing some items of the test, in addition to eliminating some items. The reliability of the test was measured using Cronbach's alphas. Reliability level was 0.86. Suitable time for carrying out the test was 30 minutes. **Field Experiment** 

After developing the instructional website, an interview held with the students (study sample). A purposive sampling method was used in the sample selection to ensure that only students who have previous experience (even little) with online learning participate in the study. As 602 students were found to be registered in seventh-grade, only 30 students were selected because they have experience in using computer and internet. The mean age of all participants was 13 years.

## Procedures

In 12/5/1432 H, the researcher applied the science achievement pretest to the students of the research sample. The students were asked to answer all the test items accurately. The purpose of this pretest is to be sure of the equality of variances between the two groups. Table (1) shows the results of the descriptive statistics of the achievement pretest of the research sample.

 
 Table 1. The descriptive statistics of the achievement pretest of the research sample

Descriptive Groups	Number	Mean	Standard Deviation
Group 1	15	8.26	1.86
Group 2	15	7.13	3.24

Table (2) shows results of independent samples T-test of participants in the achievement pretest.

 Table 2 Independent samples T-test of participants' scores in achievement pretest.

Groups	Number	Mean	Std.	Freedom	Т	Sig.
			Deviation	Degree		-
Group 1	15	8.26	1.86	29	1.17	Non
Group 2	15	7.13	3.24			

The results of statistical treatment as set out in the previous table shows that the T test value equals (1.17), which is statistically significant at the level of significance (0.05), and this means that there is no statistically significant differences between the two experimental groups, which indicates that the cognitive levels of the students are similar before the experiment, and thus can be considered equal before the experiment, and that any differences appear after the experiment due to differences in the independent variables, and not to differences already existed before the experiment between the two groups, indicating homogeneity of the two groups.

The study experiment has been implemented in the period from 6/4/1432 H to 12/6/1432 H, in the computer lab where the students study the science course through the website individually. After finishing their study, the achievement posttest was applied individually during one session on the research sample, dated 13/06/1432 H, and the test results were analyzed by statistical software package SPSS V.15.

#### **Results and discussion**

In this section, the descriptive statistics, T test results to test the research hypotheses and major findings will be presented. To test the first hypothesis, the researcher used descriptive statistics and T test and the results were as in table 3. **Table 3. Descriptive statistics of participants' scores in** 

achievement post test and independent samples T-test.

Groups	No.	Mean	SD	Freedom Degree	Т	Sig.
Group 1	15	16.13	3.15	28	1.50	Non
Group 2	15	14.33	3.39			

As depicted in table 3, the first experimental group students achieved a mean value of (16.13) and a standard deviation of (3.15) in the post application of the achievement test, while students of the second experimental group had a mean value of (14.33) and a standard deviation of (3.39). The value of T test was (1.50) at the degree of freedom (28), which is not statistically significant at the significance level (0.05), and this means that there is no statistically significant differences between the mean scores of the two experimental groups, suggesting that visual cues associated with hyperlinks were not influential on academic achievement.

Consequently, the researcher refused the alternative hypothesis which states that there is a statistically significant difference at the significance level (0.05) between the mean scores of the science achievement test for the first experimental group (which uses the web site with visual cues associated with hyperlinks) and the second experimental group (which uses the web site with hyperlinks) in favor of the first experimental group.

The researcher attributed this result to several factors, including: (a) the design quality of the instructional website, in terms of organization and integration of objects, and coordination of colors; (b) the nature of the participants' age (11-13 years), where it may be difficult for them to pay attention to visual stimuli as much focus on educational content; (c) students' enthusiasm and motivation for studying through the instructional website.

Concerning the second hypothesis, the descriptive statistics and results of paired samples T test were as in table 4.

Table 4. Descriptive statistics of the first experimental group students' scores in the pre and post application of the achievement test and paired samples T-test.

Group 1 (Visual Cues)	No	Mean	Std. Dev.	Freedom Degree	Т	Sig.
Pre test Post test	15	8.26 16.13	1.86 3.15	14	10.78	Sig.

As depicted in table 4, the first experimental group students had a mean value of (8.26) and a standard deviation of (1.86) in the pre application of the achievement test, while their mean scores was (16.13) and a standard deviation of (3.15) in the post application of the achievement test. The value of T test was (10.78) at the degree of freedom (14), which is statistically significant at the significance level (0.05), and this means that there is statistically significant differences between the mean scores of the pre and post application of the science achievement test in favor of the post application.

Consequently, the researcher accepted the alternative hypothesis which states that there is a significant difference at the significance level (0.05) between the mean scores of the pre and the post application of the science achievement test of the first experimental group (which uses the web site with visual cues associated with hyperlinks) in favor of the post application.

Concerning the third hypothesis, descriptive statistics and Paired samples T test were conducted. Table 5 demonstrates the results of those statistical methods.

Table 5 Descriptive statistics of the second experimental group students' scores in the pre and post application of the achievement test and paired samples T-test

Group 2 (Without	No.	Mean	Std. Dev	Freedom Degree	Т	Sig.
V.C)				U		
Pre test	15	7.13	3.24	14	7.22	Sig.
Post test		14.33	3.39			

As depicted in table 5, students of the second experimental group students achieved a mean value of (7.13) and a standard deviation of (3.24) in the pre application of the science achievement test, while they achieved a mean value of (14.33) and a standard deviation of (3.39) in the post application of the science achievement test. The value of T test was (7.22) at the degree of freedom (14), which is statistically significant at the significance level (0.05), and this means that there is statistically significant differences between the mean scores of the pre and post application of the science achievement test in favor of the post application. Consequently, the researcher accepted the alternative hypothesis which states that there is a significant difference at the significance level (0.05) between the mean scores of the pre and the post application of the science achievement test of the second experimental group (which uses the website without visual cues associated with hyperlinks) in favor of the post application.

# **Study Recommendations**

It is recommended to benefit from the results of the current study on the practical level, particularly if future research supported its findings; to adopt hypermedia programs to improve the instructional process; to benefit from the results of previous studies that dealt with studying the impact of different visual cues on the learning outcomes when designing and developing instructional web sites; to train preparatory-stage students to deal with hypermedia programs and instructional web sites; and finally to assure the importance of integration between electronic methods and traditional methods of education for greater efficiency in the instructional process.

## **Future Research**

It is suggested to replicate the current research with higher educational stages. Additional research to study the influence of different visual cues (written texts, frames, colors, arrows, etc...) on the achievement for the same preparatory stage. It is also suggested to conduct similar research taking into consideration the level of students' interests and motivation towards the subjects, their age, experience, and visual literacy.

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