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## The effect of the number of hints accompanying content in interactive videos on achieving some learning outcomes for female students in Hail schools

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### ABSTRACT

The aim of this study was to investigate the effects of the number of visual hints accompanying the educational content in the interactive video clips on the achievement of some learning outcomes among students of the second intermediate grade in the Ha'il region. Sixty students participated in this study and were divided into three groups and studied according to three scenarios, respectively, interactive videos without a hint, visual hints with color, visual hints with color and arrows. The results showed that a group that studied by color and hint got more results and improvements than a group that studied without a hint and visual hint with color and arrows group. This study recommended the necessity of working on the design and use of interactive video clips based on the use of visual hints in different courses, working on training teachers on how to use videos and employing them correctly, and working on conducting more research studies on the effectiveness and impact of using visual hints accompanying the interactive videos in teaching other courses.

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### 1. Introduction

The current era is characterized by a great explosion of knowledge, successive recent discoveries, and advanced communication technology; this, in turn, affected various life activities, the most important of which is the educational process. In addition to this influence, new environments and tools have emerged for gaining knowledge and building skills.

Interactive video technology is one of the most advanced developments in the history of digital information technology, as it is being used increasingly due to the contribution of this tool to help learners understand information, concepts, and facts in an easy-to-understand manner. It helps them gain unlimited and unrestricted access to information (Bétrancourt, 2005).

It should be noted that interactive videos stimulate learners' motivation and make them in a state of continuous interaction with the presented

content. Geigle (2014) confirmed that interactive videos provide learners with excitement, methods of guidance, etc., so that each learner reaches the best possible level of learning. Bonafini (2017) agreed that interactive video clips contribute to great degrees in communicating the knowledge and information presented through them with the least time and effort, in addition to their ability to convert abstract information into tangible and moving illustrations in an interesting and enjoyable way, and thus increase from the motivation of the learner towards learning, and his ability to repeat without getting bored and thus he can learn according to his own abilities and scientific capabilities.

The researchers believe that the importance of interactive video lies in its reliance on the use of different visual shapes and cues, such as text and images, animation and static, audio stimuli, colors, arrows, and shadows, and this is supported by cognitive theories, the most important of which is the dual code theory, where this theory assumes that Data or information is stored in long-term memory in two forms: Visual and verbal, and that the information that is represented in a visual and verbal form is remembered better than what is represented in one form only, and this is what Fig. 1 shows.

The theoretical basis for visual hints depends on the Cues Summation Theory, which states that

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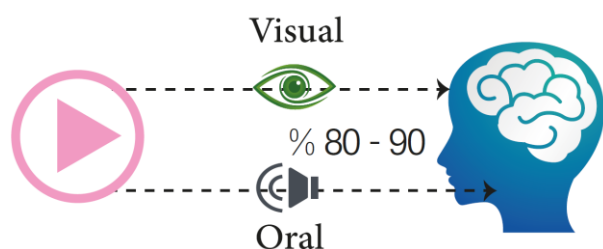
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learning increases as the number of cues or stimuli available in the educational situation increase, which means the use of the sufficient number and the appropriate type of cues (Kim, 2016).



**Fig. 1:** The percentage and type of information that reaches the brain during learning through video clips

Angeli and Tsaggari (2016) confirmed that the use of visual cues in video clips act as effective stimuli to attract the attention of learners, which greatly contributes to improving their skills and achievement. Kuzu et al. (2007) showed that visual cues shorten the cognitive content displayed in making it more fun learning. In addition, Yildirim and Caz (2018) explained that video clips and accompanying visual hints increase learners' ability to understand difficult facts by providing rich data annotations, images, and visual stimuli. The research results also confirmed that employing the appropriate style of visual cues increases learners' motivation by increasing self-efficacy and self-esteem, improving learners' attendance, in addition, to raise their level of participation in various learning activities.

Visual cues are an important factor in design because they are a method that facilitates learning and effective learning. Cues are not required to provide learners with additional information. Rather, they are used to focus on the educational stimuli that the learner should be aware of. Hints reduce the time required for the learning process, as they indicated themselves stimuli directed to attention and perception (Altakhaineh et al., 2020).

Accordingly, the researchers believe that the presence of visual cues in the structural design of interactive videos may facilitate the learning process and help the learner to reach the goal with focus and without losing time, as well as without going into details that are not important to the learner, and not related to the main topic, in addition to their presence within the content video helps with good achievement.

Mahdi (2017) aimed to investigate the effect of keyword captioning on vocabulary acquisition using mobile devices. Thirty-four learners from EFL Arab University participated in this study and were randomly assigned to two groups (video clip with caption and video with full explanation). The results indicated that the keyword explanation is a useful model for improving the learner's pronunciation. However, there was not much difference between the two translation modes.

Many studies and research have been conducted on the use of interactive video in education, such as

Wang and Kelly (2017), and this study has demonstrated the effectiveness of interactive video in enriching discussions and developing cognitive achievement and some learning outcomes in different courses.

The results of many studies and research have shown the positive effects of interactive video clips of interactive video based on the use of visual cues in helping learners acquire and install the correct performance, including the study of Jae (2019). Despite the results of previous studies, which have demonstrated the importance of an interactive video strategy based on the use of design variables accompanying it, for example, Wang and Kelly (2017). There are studies and research that have shown that they are not always beneficial: Where learners often fail to achieve educational goals and objectives with the least possible time and effort. Wang and Kelly (2017), Amarin and Al-Saleh (2020), Chen (2015), and Bulu and Pedersen (2010) explained that this failure might be due mainly to the misappropriation of learning theories so that educational videos can be designed according to these theories, not to the efficiency of the variable associated with the video clips or the way it is presented.

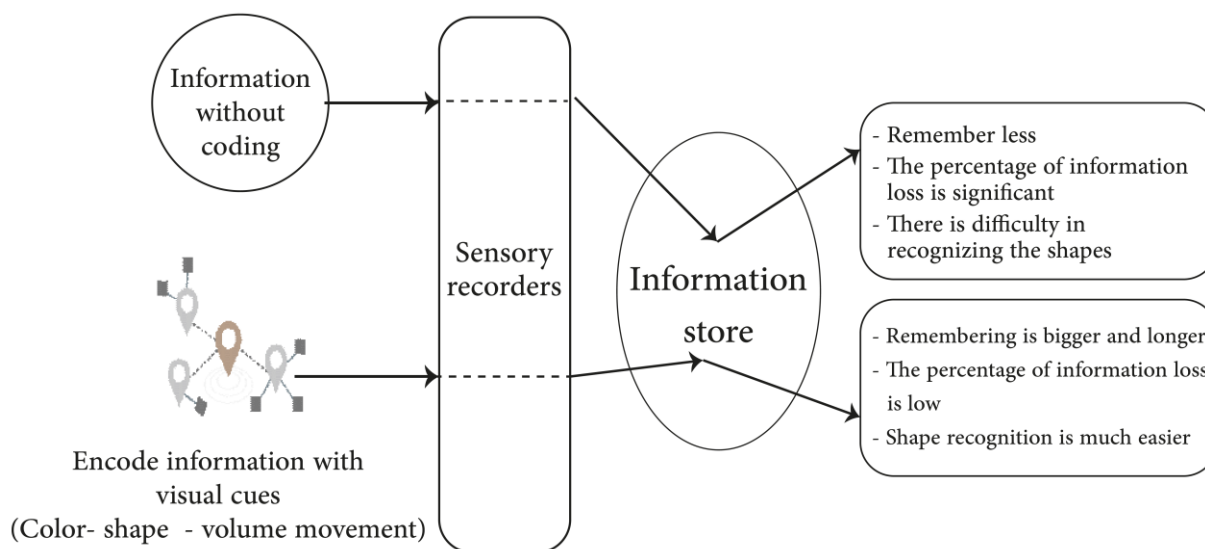
The researchers believe that producing a set of interactive video clips based on the use of a number of visual cues in light of one of the learning theories may contribute to help students process, store and recall information without overloading knowledge, in addition, to provide opportunities for interactions or bilateral contacts, and applying methods of Individualized learning. This is shown in Fig. 2.

As the coding process is regarded as the first process that the learner practices after receiving the information elements that he was exposed to while learning. In this process, the form of information is transformed and changed from its natural states that it is when presented to them into a group of pictures or symbols. That is, it turns into a code with a special meaning.

And because of the previous research and studies, it was not determined to use the sufficient number or the appropriate type to use the hints accompanying the interactive videos. Also, the design of these hints in this research was not based on specific theoretical principles, so the current research aims to reveal the appropriate number of hints that must be accompanied by the interactive video clips and can benefit the students in the second intermediate grade with the benefit in the aspect of achieving learning outcomes.

## 2. Problem statement

Social studies curricula are prepared as indicated by Sharp and Purdum (2019), one of the most important curricula, given the important role it plays in developing thinking and creativity for the learner, and because it is a material with much knowledge and many concepts that requires a combination of understanding and application on the ground.



**Fig. 2:** It demonstrates the effect of coding information, color, shapes, or movement on different learning processes

And by extrapolating the current situation of teaching methods of weather topography, climate, and other social studies topics in our schools in general, it becomes clear that they depend on imparting facts and knowledge to learners through the teacher and what he does to throw throughout the time allotted for the lesson with the occasional use of the blackboard or other educational means, in addition, to give them an enormous amount of information and interconnected cognitive elements that challenge and exhaust them. As a result, it is difficult to select from this information, which is inflated in quantity and quality and becomes distracted and unable to relate it to what is in their cognitive structure.

Accordingly, the researchers believe that the students' success in acquiring the concepts and knowledge included in the social studies subject depends on the possibility of integrating supportive activities related to the needs of the learners, which they can identify and recall them in the appropriate place and time, which leads to an improvement in their mental ability to process information and activate stored cognitive formations. And it also encourages them to choose alternatives, thus increasing the rate of understanding and remembering their visual content and improving the level of ability to self-organize information, which requires finding an innovative non-traditional method that enables teachers to help students achieve the required learning outcomes and thus the research problem can be identified in the following main question:

- What is the effect of the difference in the number of hints accompanying the content in the interactive videos on the achievement of some learning outcomes of the students of Hail schools?

The main questions are divided into the following questions:

- What skills are needed to be developed among female students of the second intermediate grade included in the tenth lesson (Elements of Weather and Climate) in the Social Studies subject at Hail Ajyal School-The Egyptian Track, in the Hail Education region?
- What is the effect of the difference in the number of visual cues (without hint-color hint-hint of color and arrows) in the interactive video clips on the achievement of some learning outcomes of the tenth lesson topics (weather elements) in the social studies subject for the second-grade intermediate students at Ajyal Hail School-The Egyptian Track, in Hail region?

## 2.1. The research aims

Current research seeks to identify:

- Detection of the effect of the difference in the number of hints (without hint-color and arrows) associated with the educational content in the interactive video clips on the achievement of learning outcomes for second-grade intermediate school students.
- Determine the most appropriate number of hints to accompany scientific content with interactive videos.

## 2.2. Research importance

Research may be helpful in:

- Employing visual cues in the educational process.
- Motivate teachers to use visual hints in achieving students' learning outcomes.
- Make available videos based on visual hints for achieving learning outcomes in the social studies subject.
- Provide results that help identify the appropriate number and type of visual hints accompanying the educational content.

### 2.3. Research limitations

The current research is limited to:

- Objectivity Limitations: Social Studies curriculum, second grade, intermediate, lesson ten (Elements of Weather and Climate)
- Place Limitations: Ajyal Hai'l School-the Egyptian track.
- Time Limitations: The first semester 1440 AH
- Designing three types of treatments
- 3 videos without a hint.
- 3 color hinting videos
- 3 color and arrow tip videos (dual hint).

### 3. Research methodology

In light of the nature of the research, the researchers used the experimental method with a factorial design ( $3 \times 1$ ) to study the effect of the difference in the number of hints accompanying the educational content in the interactive video clips on the achievement of some learning outcomes for the second-grade intermediate students.

#### 3.1. Research experimental design

The current research relies on the design of multiple groups, as shown in Fig. 3.

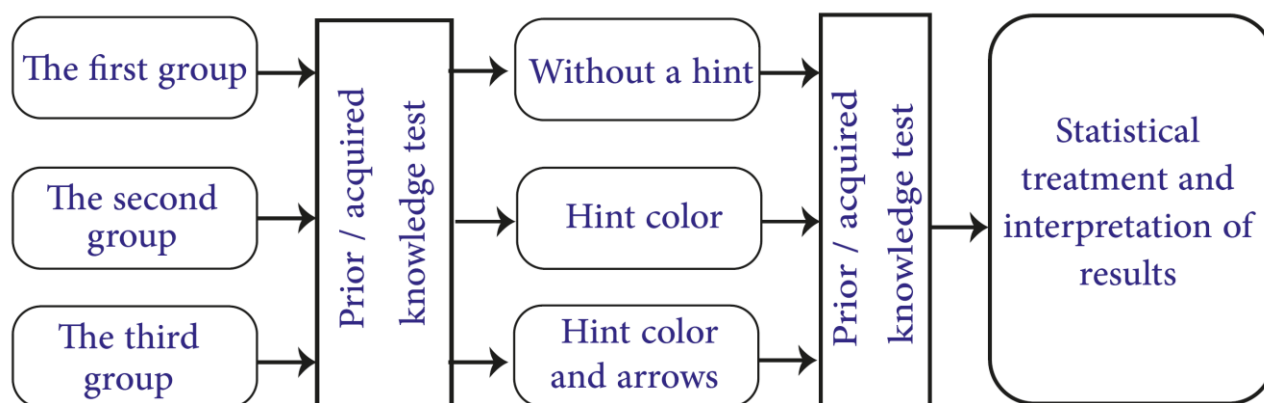


Fig. 3: Research experimental design

#### 3.2. Research variables

- Independent variables: The number of hints accompanying the educational content in the interactive videos and has three levels:
  - No hint (View educational content with interactive videos without a hint)
  - Single hint (Display educational content with interactive videos with a color hint)
  - Dual hint (Display educational content in videos with a hint of color and arrows together)
- Dependent variables:
  - Learning outcomes

knowledge test/acquired due to the impact of the fundamental difference in the pattern and number of visual hints.

#### 4. Research procedures

The two researchers explain the procedures that were followed in designing experimental treatments (interactive videos based on the use of a number of visual hints to achieve learning outcomes for second-grade intermediate students, and the two researchers used the General Design Model (ADDIE), and this model consists of five main steps. The model derives its name from it, which is (analysis, design, production, implementation, evaluation), as shown in Fig. 4.

#### 3.3. Research tools

- Pre-Test/acquired knowledge (prepared by the researchers).
- Experimental treatment material: A number of video tutorials based on the use of a number of visual cues.

#### 3.4. Research hypothesis

The research hypothesis can be formulated as follows:

"There are no statistically significant differences on the level of 0.05 between the average scores of the three experimental groups in the prior

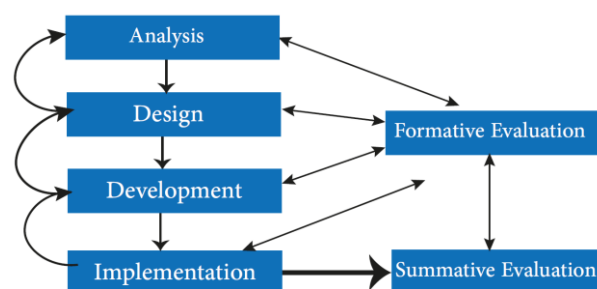


Fig. 4: The ADDIE model

The two researchers have made some adjustments to the steps included in the model to suit the nature of this research. These steps can be presented as follows.

#### 4.1. Analysis stage

- Problem analysis and needs assessment: The current research aimed to develop educational content in interactive video clips based on the use of a number of visual cues (color-arrows), with the aim of helping second-grade intermediate students to achieve learning outcomes included in the tenth lesson topics (Elements of Weather and Climate) with the social studies subject.
- Defining educational goals: The current research is based on the general goal of developing educational content with interactive video clips based on the use of visual hints to help the students of the research sample to achieve learning outcomes in the social studies subject, and it is divided into four main objectives, including the three units:
  - To familiarize students with the concepts related to temperature and different methods of measuring it
  - To familiarize the students with the concepts related to atmospheric pressure, its types, and characteristics.
  - To familiarize students with the concepts related to wind, its types, and the devices used to measure it.
  - To familiarize students with concepts related to humidity and its measuring devices.
- Analyzing learners' characteristics: The characteristics of the learners were identified, which are represented by students of the second intermediate grade-the Egyptian Track, and their ages ranged between 14-15 years, each of whom had a computer connected to the Internet or a mobile phone.
- Analyzing the educational environment: The researchers have developed educational content with interactive video clips based on the use of visual hints in light of the skills they have in the design process for a set of lessons and topics for the social studies subject that is presented through the current research variables, and three groups of videos are presented that differ among themselves in the independent variable.

#### 4.2. The design phase

- Defining procedural goals: A list of educational goals that students should reach by the end of their studies has been prepared through interactive video clips, and this list is based on topics (concepts related to temperature and its various methods of measurement, concepts related to atmospheric pressure, its types and characteristics, concepts related to wind and its types and devices used in measuring it, concepts of humidity and its measuring devices).

The conditions and principles that should be taken into account in formulating the educational goals have been taken into consideration, and they have been presented to the judges, and they have been modified in the light of what they have shown, and the number of goals has reached 17 goals.

- Interactive video content design: The educational content has been prepared in a wide range of multimedia that suit the nature of each educational vocabulary so that it effectively presents the required content, which is represented in texts, arrows, images, and other media as elements for building the educational content with interactive videos, and the content has been divided into four topics: (Heat measuring paper-atmospheric pressure, types and methods of measuring it-wind and its types, and devices used to measure it-humidity and measuring devices).

To ensure the validity and coherence of the content, it was presented to a group of experts in educational technology, science, and social studies teaching curricula, where the course was presented to them with its objectives in order to explore their views on the extent to which the educational content is related to the objectives and the adequacy of the content to achieve the goals and the appropriateness of dividing the content into lessons and separate learning elements. It has been decided to choose the content on which 80 or more of the experts agreed on its relation to the previous elements. The experts also agreed on the validity of the content with a procedure related to the reformulation - and the researchers made adjustments, which made the content ready in its final form in preparation for use in a learning environment.

- Organizing the elements of educational content: The researchers identified and organized the elements of the educational content. In order to achieve the desired goals of the interactive videos, the arrangement and organization of the content (the four topics) from simple to complex (hierarchical succession) was taken into account, in addition, to take into account the characteristics of the learners, and the researchers presented the content to a group of experts in the field of curricula and education technology, some parts of the content have been modified in light of the opinions suggested by the experts.
- Visual hint design (color hint, arrow hint): The researchers designed two visual hint modes (color hint, arrow hint) in which the tenth lesson topics (weather and climate elements) are presented. A visual hint includes coloring the information in lessons, as well as drawing arrows in front of, below, or above some information.
- Designing educational activities via interactive videos: The researchers designed educational activities within the interactive videos so that these activities are used to serve specific educational



situations related to educational content in video clips.

#### 4.3. Development/production stage

This stage consisted of the following steps:

One of the requirements of the current research is the production of three groups (each group includes 3 clips of the interactive video) in light of the levels of the independent variables, taking into account when producing them that the only difference between them is in the levels of the independent experimental variables, so the researchers produced the videos according to the following:

- Digital content production for interactive videos

The researchers prepared the content of the video clips, including the elements and icons, using Adobe Photoshop cc, After Effects, and Microsoft was used to produce the content.

- Production of various video media and elements

The interactive video elements and media were produced with different styles of hints (color-color

and arrows together) according to what was reviewed in the design stage and were grouped into a single video snapshot as shown in Figs. 5 and 6.

#### 4.4. The implementation phase

At this stage, the actual use of the outputs of the previous development stage begins, where experimental treatments have been made available to the three research groups on the research sample students, and it has been ensured that the teaching materials and activities work through interactive videos well with the students, in addition, to test experimental treatments in their initial form. And making sure of its applicability, as well as controlling and reviewing the elements of the learning environment.

#### 4.5. The evaluation stage

The evaluation takes place during all stages of the educational design process, that is, during the different stages, between them and after implementation as well. This stage includes two types of evaluation, namely:

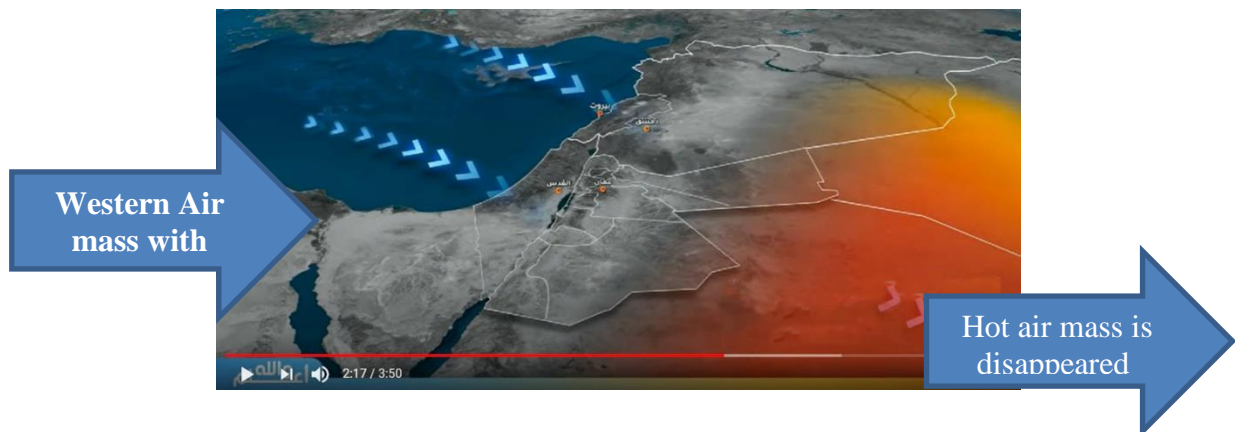


Fig. 5: Educational content with color

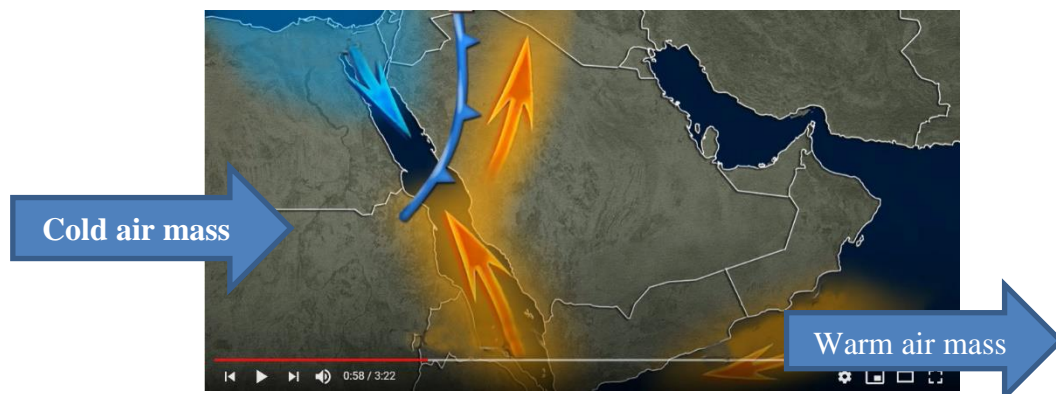


Fig. 6: Educational content with arrow and color hint

- Formative evaluation: It is a continuous evaluation during each stage of the design and production of experimental treatments for research, and between the different stages, and aims to improve the teaching and learning of students before putting

the treatments in their final form into the subject of implementation.

- Summative evaluation: This type of evaluation takes place after the implementation of the final form of teaching and learning. This type evaluates the overall effectiveness of education.

## 4.6. Designing measuring tools

### 4.6.1. Prior/acquired knowledge test (Prepared by the researchers)

- Determining the purpose and type of test questions: The prior/acquired knowledge test aims to measure the level of knowledge of the students about the topics included in the tenth lesson (Elements of Weather and Climate) in the subject of social studies for the second intermediate grade. Where the type of test questions was determined from (multiple-test, completion) questions; As it is appropriate to the nature of the teaching content, and the scientific and linguistic accuracy was taken into account when formulating the test questions, and that the question contains only one answer, in addition to the links to the educational content of the interactive video clips based on the use of visual hints.
- Preparing a table of specifications and relative weights for the test: The specification table aims to define the topics covered by the test, in addition, to identify the questions that relate to each of the first levels of Bloom Taxonomy (remembering, comprehension, and application). It has been taken into account that the test items include all the scientific content that the students have studied.
- Formulation of test instructions: The instructions were laid down on the first page of the test, and it was taken into account during their formulation that they were clear and precise and was formulated in a manner commensurate with the level of the second intermediate grade students.
- Scientific controlling of the test:
  - Verify the validity of the test: To assess the validity of the test, it was presented in its initial form to a group of experts in order to ascertain the extent of the clarity of the questions and instructions, the extent of their relevance to the behavioral objectives of the scientific content, and their suitability for the characteristics of the research sample students.

The experts agreed on the validity of the test for the purpose for which it was prepared, and accordingly, the researchers modified the initial image of the test in the light of the experts' proposals, and it became ready for use.

- Reliability of the test: Calculation of Reliability of the test factor: The researchers calculated the reliability using the retest method by calculating the Pearson Correlation coefficient between the two applications, and the results were as [Table 1](#).

**Table 1:** Test reliability

Type of test	Number of female students	Correlation coefficient value	Indication level
Achievement	60	0.991	0.01

It is evident from the results of [Table 1](#) that the value of the test reliability coefficient=0.991 and this indicates that the test has a high degree of reliability.

- Determine the test time: The average time taken to perform the test was calculated, and the test time was approximately 20 minutes.
- Score estimation and correction method: One single score was assessed for which the student answered correctly, and zero for each item she left or answered incorrectly, provided that the total score of the test is equal to the number of test items.

After completing the test preparation procedures, verifying its validity and reliability, and controlling it statistically, the test became valid in this way in its final form.

### 4.6.2. Basic research experiment

The field experiment implementation process went through several stages, namely.

**A. Selecting the research sample:** The research sample was selected from the second-grade female students, intermediate in Ajyal Hail School-the Egyptian track, in Hail Region, and the number of samples in the final experiment was 60 students, and they were divided randomly into three groups, each group consisted of 20 students.

**B. Piloting the research tools:** The prior application of the prior/acquired knowledge test was carried out on the main sample of the research, on Sunday 7/4/2019, with the aim of ensuring the equivalence of the three groups before applying the experimental treatments, as well as determining their academic level.

**C. Ensure the homogeneity of groups:** The researchers analyzed the results of the pre-application of the test before conducting the experiment in order to ensure the extent of homogeneity between the three research groups. The researchers used a one-way analysis of variance (ANOVA).

It is evident from the results in [Table 2](#) that there is no discrepancy in the values of the averages for each group, which indicates that there are no statistically significant differences between the research groups, which means that the groups are equal in academic achievement and that the differences that appear after conducting the experiment are due to differences in Independent variables, not to a difference that already existed between the three groups before the experiment.

**Table 2:** The significance of the differences between the research groups in the pre-measurement

N	Std. Deviation	Mean	Groups
20	0.923	1.70	1.00
20	0.951	1.80	2.00
20	0.933	1.85	3.00

#### 4.7. Implementation of the experiment

After completing the pre-application of the test and ensuring the homogeneity of the three groups, the basic experiment was carried out from 4/21-30/4 2019.

#### 4.8. Post-implementation of the research tools

After completing the basic research experiment, a prior/acquired knowledge test (dimensional) was applied in order to identify the differences in the learning outcomes of the three experimental groups that studied the program based on visual hints. Where the test was applied on Sunday, 2/5/2019.

### 5. Research results and their interpretation

To answer the question, "What is the impact of the different number of hints associated with the content of educational clips interactive video to

achieve some of the learning outcomes of the second-grade students' average? The researchers used the one-way Anova test to calculate the significance of differences in test scores. Software package SPSS was used to test the research hypothesis.

"There are no statistically significant differences on the level of 0.05 between the average scores of the three experimental groups in the test prior knowledge/acquired due to the impact of the fundamental difference in the pattern and number of visual hints."

Table 3 shows the results of One Way Anova tests to find out the significance of the statistical differences between the three groups.

It is evident from Table 3 the average scores of the members of the three research groups in the prior knowledge test/acquired are in order 13.35, 16.05, 19.25, and the lowest averages were the average scores of the members of the first group (without hint), and the highest was the third group that used the two-hint. (Color and arrows).

**Table 3:** Descriptive statistics of the results of the post-achievement test of the research groups

Maximum	Minimum	95% Confidence Interval for Mean		Std. Error	Std. Deviation	Mean	N	
		Upper Bound	Lower Bound					
16.00	11.00	13.962	12.737	.293	1.30	13.35	20	1.00
17.00	14.00	16.465	15.634	.198	0.887	16.05	20	2.00
20.00	18.00	19.618	18.882	.176	0.786	19.25	20	3.00
20.00	11.00	16.896	15.537	.339	2.63	16.21	60	Total

To find out if there is a statistical significance between those averages and the three experimental research groups, the researchers prepared a summary of the results of the one-way analysis of variance on the scores of the members of the three experimental research groups in the post-measurement with respect to the averages of the degrees of the prior/acquired knowledge test, and this is evident in Table 4.

**Table 4:** Results of one-way analysis of variance

Sig.	F	Mean Square	df	Sum of Squares	Source of Variation
.000	167.841	174.467	2	348.933	Between Groups
		1.039	57	59.250	Within Groups
			59	408.183	Total

Table 4 shows that the value of the ratio alpha averages test scores prior knowledge/acquired function at the level of 0.05, and it is clear from this that there are statistically significant differences between the averages of students grades-three research groups experimental group (without hint), A group (color hint), a group (color hint and arrows), in the post-measurement in the prior/acquired knowledge test, that is, between the three treatments in achieving the learning outcomes of the tenth lesson content (weather and climate elements), meaning that the effectiveness of those treatments in achieving the learning outcomes was differentiated, showing differences between them.

Based on the above, the first hypothesis states: There are no statistically significant differences on the level of 0.05 between the average scores of the three experimental groups in the prior knowledge/acquired test due to the effect of the fundamental difference in the pattern and number of visual hints."

And accepting the alternative hypothesis, where the results of one-way analysis of variance indicated that there is a statistically significant difference from the level of 0.05, between the mean scores of the students-research groups-in the post-test measurement related to subjects studying the elements of weather and climate due to the difference in the pattern and number of hints, to become alternative hypothesis "There are statistically significant differences in the level of 0.05 between the average scores of the three experimental groups in the prior knowledge/acquired test due to the effect of the fundamental difference in the pattern and number of visual hints."

To find out the location and direction of these differences, the t researchers used the Tukey test for post comparisons, as shown in Table 5.

The mean difference is significant at the 0.05 level.

It is clear from Table 5 that: There were statistically significant differences at the level of 0.05, in the averages of the scores of the prior knowledge test/acquired between the first groups (without hint) and the second group (the color hint),



in favor of the second group with the highest average, where the average scores of the first group members were 13.35 The average for the second group 16.05.

**Table 5:** Tukey test results in differences between the three experimental research groups

Sig.	Std. Error	Mean Difference (I-J)	(J) groups	(I) groups
0.000	0.322	-2.700*	2.00	1.00
0.000	0.322	-5.900*	3.00	1.00
0.000	0.322	2.700*	1.00	2.00
0.000	0.322	-3.200*	3.00	2.00
0.000	0.322	5.900*	1.00	3.00
0.000	0.322	3.200*	2.00	3.00

The presence of significant differences (0.05), in the mean of the test scores between the first groups (without hint) and the third group (hinting color and arrows), in favor of the third group, where the average scores of the first group members were 13.35, and the average of the third group was 19.25.

There are differences at the level of 0.05, in the mean of the test scores between the second groups (hinting by color) and the third group (hinting by color and arrows) in favor of the third group, where the average scores of the members of the second group were 16.05 and the average of the third group 19.25.

This indicates that the two-pattern of visual hints (color and arrows) was more effective than the hint-color pattern and the non-hinting pattern, meaning that there is an improvement in the level of students in terms of achieving learning outcomes for the tenth lesson topics (weather and climate elements) to a large extent when using the hints visual dual pattern (color and arrows).

## 6. Interpretation of the results

- This result is in agreement with [Zeglen and Rosendale \(2018\)](#) and [Plass et al. \(2014\)](#), whose results indicated the ability of visual hints in developing the achievement and achieving learning outcomes of the learners, which confirmed the existence of a statistical significance indicating the high rates of achievement and achieving the highest percentage of learning outcomes in the three groups (without hint), (color hinting), (color hinting and arrows). The hinting pattern by color and arrows is the most effective pattern in achieving learning outcomes, and the researchers attribute this result to the various advantages provided by this pattern that helped guide students to the information and concepts to be learned using what facilitated effectively in improving the teaching and learning processes.
- The experimental treatment based on the interactive video clips accompanied by a number of visual hints (the double hint) helped the students to identify the basic ideas and principles that link the concepts in the learning topics, as well as the opportunity for them to participate actively in learning and discover the knowledge of learning

topics on their own, which led to the permission. They have to practice the processes of observation and deduction. This is in agreement with the allusion theory, which states that "learning increases as the number of allusions increases in an educational situation."

- The importance of color appears as a hint in clarifying and attracting attention towards the information to be known and focusing on it in the educational content in the video clips, and this is consistent with many studies and research that have emphasized the importance of color in clarifying concepts, such as the study of [Amarin and Al-Saleha \(2020\)](#), and [Alhagan \(2016\)](#).
- It is noticeable through the results that the students of the research sample achieved great progress in achievement, as the different patterns of visual hints raised their motivation towards achieving learning outcomes and, to a greater extent, in their ability to re-attempt learning many times with what is called academic perseverance.

## 7. Research recommendations

- The importance of studying design variables for interactive videos and their relationship to learning outcomes.
- The necessity to use interactive videos with different design variants to teach other skills and knowledge.
- Conduct more research on hint pattern variants with other strategies such as flipping classes.
- Ensure that the activities in the classroom are complementary to the activities outside it and are based on the application of learning and the conduct of discussions.

## 8. Research suggestions

- Applying the design of the experimental process for designing educational content through interactive videos based on the use of visual hints to other courses and classes.
- Compare other hints from visual hints not covered in the current research.
- Conducting similar research in other educational stages.

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## Compliance with ethical standards

## Conflict of interest

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