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The impact of visual ergonomic control elements and learning methods on developing website design skills among educational technology students

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ABSTRACT

The main goal of a website's ergonomics is to meet the user's specific needs in the most efficient way, ensuring ease of interaction with the site's content. This includes making text easier to read, making information easier to find, and making actions easier, such as requesting a product or service, Therefore, the current study aimed to study the effect of visual ergonomic control elements and learning methods on developing website design skills among educational technology students, The sample consisted of 60 students in the Department of Educational Technology and Computers at the Faculty of Specific Education, Kafr Elsheikh University, in the e-learning course. The students were divided into four experimental groups of 15 students each, by classifying the students into two categories of learning methods (visual - auditory), and each category of learning methods. Previous learning is divided into two categories according to the use of (visual ergonomic control - traditional learning method) the results of the research found that students with a visual learning style and the use of ergonomic adjustment factors are more effective in enhancing students' website design skills.

KEYWORDS: Visual Ergonomics, Control Elements, Learning Methods, Website Design Skills, Educational Technology Students, User Interface Design, Human-Computer Interaction, Digital Learning, Cognitive Load, Interactive Design

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Introduction

Have you ever asked yourself why a certain ad attracts more attention than another? And why do you end up going to the supermarket to buy the most unhealthy things for you? Well, this is because of the secret science of visual ergonomics, which is the study of ergonomic elements to enhance or improve the relationship between humans and design. Ergonomic elements affect the design and production of any visual product, as they include the basic design elements (color - graphics and images - balance - texts). Which in turn affects the compatibility and comfort of the visual product with the human eye.

The sense of sight is the most important of the human senses among the five human senses, as many studies have shown that up to 90% of the information gained from the environment is done through the eyes) Jung, Shin, & Kee, 2000).

Excessive use of technology can lead to eye strain, headaches, blurred vision, dry and sore eyes, double vision, and light sensitivity. Cheryl Bennett, Andree Woodcock, Diane (Frumkin, Geller, Rubin, & Nodvin, 2006) Tien explain the role of ergonomics in promoting the long-term health of the next generation and in making educational environments more

Successful ergonomic design of the work environment is a comprehensive task, because all the interconnected parts of the work environment work together to form that environment. Where work tasks and work activities interact with each other. It affects and is affected by components of the work environment, furniture and other equipment in the environment. All of these in turn must "fit" the individual to support their well-being and contribute to work outcomes, and many other social and organizational factors also influence feelings, attitudes and performance.(Harris & Straker, 2000) (Heyman & Dekel, 2009)

Theoretical framework

The current study attempts to address the impact of visual ergonomic control elements and learning methods on developing website design skills while teaching an e-learning course.

Therefore, visual ability and the standards imposed to properly process visual information and task requirements should be considered in order to optimize the arrangement of visual elements and control elements, which in turn works on the target's visual comfort while increasing the number of hours of use, which leads to ease of reading and ease of use and navigation.(Jung et al., 2000)

The elements of visual ergonomic control are crucial because if the human brain is the main controller of the human body, then the visual ergonomics is what deceives and controls it to make decisions according to it, and thus control this body, therefore it can be confirmed that by using the visual ergonomics we can control In the human body (Long, 2014)

Visual ergonomics is a science concerned with understanding human vision and understanding the processes and interactions between humans and other elements of the system. It is the science that applies appropriate theories, knowledge and methods in designing what can provide humans with visual comfort, a comfortable and safe life, and better performance in their personal and professional life tasks. (Karwowski, Szopa, & Soares, 2021)

T J Smith's study (Smith, 2007) describes how the ergonomic design of the learning environment affects learning performance, which is that students' performance largely depends on the specific context influenced and specialized in relation to specific design controls in the learning environment.

Perhaps the main question is what are the design characteristics of the visual learning environment. In practice, the primary challenge is to apply this scientific concept to ergonomic interventions towards improving the design of learning environments to maximize the learning-learning process.(Smith, 2007)

An educational website ergonomics is a system that focuses on optimizing a website to ensure a comfortable and efficient user experience. It is a system that integrates the principles of educational website design, educational psychology, and interface engineering to create a user interaction experience that easily meets user needs. The primary goal of the ergonomics is to enhance the ease of use of the website, which in turn enhances user satisfaction and achieves various educational objectives, Website users may have difficulty managing the flow of information in dynamic environments (Leaver & Reader, 2016)

Therefore, meeting the user's needs in an effective manner is the main goal of the website's visual ergonomics, which ensures ease of dealing with the site's interactive interface. This includes ease of reading text,

ease of finding information, and ease of performing actions. Accordingly, a good visual organization of website content not only makes it easier for users to find the necessary information, but also significantly increases the likelihood that they will stay on the site for a longer period and perform targeted actions.(Choppin, McDuffie, Drake, & Davis, 2018)

In this context, the study by Hafizah, Abdullah Ali (Abdullah, Ali, & Hazali, 2018)points out the importance of visual elements in designing an educational website, the problem faced by web designers in designing the visual element, and their suggestions related to designing an educational website based on visual elements. This study found that designers agree that there are some shortcomings in some aspects of design elements, but most web designers agree that design elements are very important in web design.

Fernando Moreira da Silva Cristina Pinheiro's study(Pinheiro & da Silva, 2012) aimed to define specific design controls to be applied to visual design objects, so that they are easier for everyone to read and perceive. It was concluded that applying design controls and a visually accessible work environment would be effective and easier on the eyes of website users.

If this research is applied to the design and production of websites, visual ergonomics means the extent to which the recipient's eye accepts the appearance of the website from an aesthetic point of view, while achieving the functional aspect of ease of browsing and receiving the greatest amount of information in a way that is interesting to the target group and without eye strain. Visual ergonomic controls for website design elements can be addressed as follows:

Color:

Color is the basic unit of visual information acquisition(Ni & Wang, 2020), Color is considered the basic element in design and has a special importance that differs from the importance of any other element of design, as visual perception depends primarily on color, as color is the basic unit for acquiring visual information, and the individual's mood and emotional state are affected by colors, (Siu, Lam, & Wong, 2017) and color is linked to the culture of societies and their legacies. With human connotations and associations, people's perception of colors varies greatly, as they directly affect the human psyche,(Elliot & Maier, 2014) and all human languages share in reading and recognizing colors. Rather, it is in itself an easy language that everyone understands equally, and color is considered one of the elements of communication that contributes effectively to Design process(Ni & Wang, 2020)

Color is one of the most important variables that determine a person's visual perception of the scenes and events surrounding him(Valdez & Mehrabian, 1994)

This theory was developed by Goldstein,(Goldstein & Rehabilitation, 1942) who confirmed that some colors produce systematic physiological reactions that appear in cognitive achievement and affective aspects. Many researchers have indicated that there is a strong relationship between the color element and the learner's excitement. For example, we find that warm colors are exciting and stimulating, while cold colors give a feeling of calm and relaxation. (Elliot & Maier, 2014) Some researchers have hypothesized that color, as one of the elements of ergonomic control, can be used in treating... Information in a manner consistent with the learner's comfort and impressions (Meier, D'agostino, Elliot, Maier, & Wilkowski, 2012)

Many research papers discuss a variety of tasks and environments in which visual ergonomics are important. Visual ergonomics is often related to color contrast and brightness, so it is appropriate to begin by discussing this topic. Tan, Boone, and Dane study notes that posters and control tools are included within Software and websites on electronic devices with poor color contrast and brightness may pose difficulties for people with low vision.(Tan, Boon, & Dain, 2014)

The study by Tomingas et al describes risk factors for the occurrence of certain symptoms associated with visual discomfort among desktop computer users due to poor color contrast. (Toomingas et al., 2014)Hu, Rosenfeld, and Saya compare the rate of eye-related symptoms and reading performance when reading from electronic devices and printed text.(Hue, Rosenfield, & Saá, 2014)

Color contrast is one of the most important elements of ergonomic control for controlling learning performance. Contrast can be described at its simplest level as "a clear difference between two or more things. (Smith, 2007)

In the case of designing and producing an educational website, it is necessary to study the psychology

of color and its effect, taking into account the standards for the use of colors on websites, in order to take into account the group using this website and to take into account their individual differences in terms of visual strength and different color preferences (Ng, Chan, & Application, 2018) (Li, Wu, Li, Yang, & Application, 2016). Researchers have concluded points that must be taken into consideration. When students produce an educational website, they are:

- Taking into account the contrast and degree of color brightness between the texts and the range of colors used on the website pages
- Taking into account consistency and harmony between the color of the elements on the home page and the background color.
- Use many color combinations with monochromatic backgrounds.
- It is preferable not to use explicit colors

Pictures and drawings

Ergonomic visual elements of all kinds (photographs, charts, illustrations, and paintings) are essential to good design. Its purpose is to enhance and refine learners' visual perception, without which the learners' creative artistic production capabilities would be weak.(Ryan, 1993)

It also allows students to develop and transfer special knowledge and skills that cannot be developed through other artistic media(Linardi**ć**, 2015)

Visual presentation involves organizing content on a page, and using pictures, charts, videos, and other visual elements to complement or explain textual information. Effective visual presentation helps:(Choppin et al., 2018)

- Highlight the main ideas
- Visuals can act as "points of interest," drawing attention to the most important points.
- Improve understanding
- Complex ideas are often more easily understood through pictures
- Increased emotional impact
- Images, videos, and graphics can elicit an emotional response and make the content memorable.
- Using these methods to create content not only enhances the effectiveness of the site's ergonomics, but also significantly improves the overall user experience, which contributes to achieving the goals.

Teachers often rely on visual images to illustrate abstract concepts as they focus on related elements. (Damiano, 2013), There are many studies on the effect of digital images on learning: (Calvani, 2011) (Paoletti, 2011) emphasizes the necessity of relying on images to support remembering and activate the persistence of the learning effect.

(Mayer, 2014)supports the principles of multimedia learning and their relationship to cognitive load theory (Sweller, 2011), which considers the crucial role of images to be a good understanding of oral and written text.

Pictures are of great importance in the design and production of any visual product, as a picture is better than a thousand words. Many recent studies have proven the importance of pictures, drawings, and video in visual educational products. Pictures and drawings are of great importance in facilitating the path to learning instead of limiting knowledge, perception, and semantic ambiguity. For some concepts (Zeki, 2010)
Serena Triacca's study, 2023 (Triacca, 2017), aimed to take into account the importance of images and drawings in the teaching and learning process. Her study aimed to increase educational research interested in using images and drawings in the educational field, as well as highlighting the representation, design and display of learning objects on digital screens, as they are the most widely used technological features(Rivoltella & Sinini, 2012) (Ferrari & Rivoltella, 2010)

Images, drawings, and videos are the basis for designing and developing electronic websites, which makes them more attractive, more illustrative, and also more realistic.(Sweller, 2011) (Triacca, 2017)

Based on the above, a proposal for ergonomic controls for the use of images and graphics in developing websites can be developed as follows:

- It is preferable to use pictures and drawings on the main page to express and indicate the elements on

the following pages

- The image used must be appropriate for the educational goal for which it was created.
- The image content must be appropriate to the title of the item
- There must be a visual representation of each element of the file (pictures - drawings) on the main page
- Videos are used on the website pages and not on the home page
- When placing a display platform with changing images, the images must be displayed in a logical order that is comfortable for the eye

Text

Text is the first component of the content on the website and plays a major role in ensuring the effective working environment of the site, as the ease of reading the text and the visual display of the information become among the most important factors that contribute to the user staying longer on the site.(Choppin et al., 2018)
Texts constitute a powerful tool in teaching concepts and knowledge, so attention must be paid to how readers extract information from the text, what are the essential matters for understanding the text and learning from it based on a coherent mental representation that integrates textual information and relevant basic knowledge(Van den Broek, 2010)

The elements of ergonomic control in an educational website are not complete unless the selection of good texts suitable for the educational objectives is complete, with different colors, sizes, and types in accordance with the color of the background and other elements on the screen and the characteristics of the text (such as the content/structure of the information provided, processing requirements, and textual signals).(Van den Broek, 2010) (Hu, Yan, Yan, Geng, & Liu, 2020)

Readability is determined by how easily text can be read and understood by users, To enhance readability, it is important to use (Choppin et al., 2018) (Hu et al., 2020)

- Short paragraphs and sentences
- This makes the information easier to understand and helps avoid "verbalization," which can deter readers.
- Featured headings and sub-headings
- It helps users quickly navigate the content and find the necessary information.
- Lists
- This adds structure to the text and makes it more scannable for users.
- Choose readable fonts
- Choosing the font type is very important. It is recommended to use fonts with high character recognition and sufficient spacing.

A proposal for ergonomic controls for using writings on an educational website can be developed as follows:

- Use an appropriate font in the text, while the font varies in titles depending on their place and location on the pages.
- Use simple language in the titles to help the user gain quick access.
- Use brief writings because websites are more about pictures and videos.
- It is preferable to use writings that are appropriate to the background and elements to achieve ease of reading.

By using these ergonomic controls, the website will attract the user's attention and be comfortable for the eye over the long period of use

Balance

Proper balance is an essential part of building high-quality visual communication. If the design is out of balance, the actual message can be lost in the process. Hence, the essential element of communication is balance. (Horne, 2000)

There are two ways to balance the composition. The first is if the balance is symmetrical, the second is if it is asymmetrical. Symmetrical balance occurs when equal masses are on equal sides. The downside of

this combination is that it is boring, as half of the composition mirrors the other half and it becomes difficult to change anything. On a symmetrical website, everything is reflected around a vertical axis down the center page. The logo, navigation bar, images, and title are centered. These types of sites are pleasing to the eye, which increases the appeal of these elements (Setiawan, 2017)

Asymmetrical balance comes from unequal visual weight on each side. One side may be dominant while the remaining weights may have lower pivot points. This balance is more interesting compared to the previous one. It evokes a feeling of dynamism, vitality and energy (Kadry, 2017)

Most traditional symmetrical designs work well and feel balanced, one example of a symmetrical website design is Apple. Their website is known for its simplicity of design, and to have a harmonious and harmonious look, a balance between color, design and image is required in the websites, however, there are brands that use asymmetric layouts to draw the eyes where they want. (Vasseur, Léger, & Sénécal, 2020)

A balanced image draws the viewer's eye throughout the image evenly, without relying too heavily on one particular aspect of the image. Incorrectly balanced images are often less attractive to look at, especially if the "heaviest" part of the image is on the far left or right. Symmetry in images is achieved when both sides of the image have equal weight. Asymmetrical balance, on the other hand, is a bit more difficult to achieve. The more aware you are of asymmetrical balance the easier it becomes in your daily practice. Professional photographers often prefer asymmetrical balance due to the complexity of the image. When an image is symmetrically balanced, this symmetry is initially apparent to the viewer. However, when an image is asymmetrically balanced, the viewer must spend more time looking at the image to perceive the truth)Lopes, Correia, & Machado, 2023( )Beaird, Walker, & George, 2020(have explained the importance of balance and distribution of blocks in design. The balance of the blocks of elements on the website's home page is considered one of the main factors for judging the quality of the website in terms of eye comfort and enabling the user to continue browsing and wandering, because Lack of balance causes eye strain and makes it unable to continue. We find that Google Sites, which is one of Google's tools, has made available some ready-made design models that take into account the balance between the blocks of existing elements. When the user is forced to create additional elements outside of the ready-made models, the following must be taken into account:

- Maintain comfortable margins on the page
- Distribute the masses of the elements well, so we do not find heaviness in one side or the other
- Maintain comfortable spaces between items
- Maintaining the relationship between the size of image blocks and the size of text blocks
- On the pages following the main page, it is preferable that each page include one element

Learning methods

(Maxwell & EREMIE, 2017) believes that they are "the ways that distinguish the individual in his learning of various tasks, and they can be more automatic than the cognitive strategies that are considered more optional," while he believes that "learning strategies" are the method that the learner conforms to when He studies various strategies and can choose among them to deal with the task before him.

(Annual, Samat, Karim, & Hashim, 2017) refers to the learning style: "It is the individual's own way of processing and focusing on the new material, and every individual has a learning style, and this style for the individual is like a finger print, and individuals learn in an easier way when they receive information." The same way they treat it."

Roing & Rayan (2016) (Chen, 2018) explained that (learning and thinking methods) means using one or both hemispheres of the brain in the mental processes related to processing information and behavior. Related to this concept is another concept, which is (cerebral dominance style), which is known as the cognitive style. It is characterized by the consistent use of processes related to one or both hemispheres of the brain, and thus it links both learning and thinking styles on the one hand, and cerebral dominance and cognitive style on the other hand.

Researchers here define it as the individual's method of receiving various visual information and the method of processing it in a manner consistent with his cerebral sovereignty. If the individual is able to harmonize the method of receiving and processing information, this helps to obtain the targeted educational outcome.

Methodology

Research design and participants

The current research relies on an experimental design to demonstrate the effect of the two independent research variables (visual ergonomic control factors - learning style) to develop learners' website design skills. The sample consisted of 60 students in the Department of Educational Technology and Computers at the Faculty of Specific Education, Kafr El-Sheikh University, in the e-learning course. The students were divided into four experimental groups, each group having 15 students, by classifying the students into two categories of learning methods (visual - auditory), and each category of the previous learning methods was divided into two categories according to the use of (visual ergonomic control - traditional learning method) as shown in Table 1.

Table 1 Design and distribution of experimental groups

Auditory learning method (30 students)	Visual learning style (30 students)
Traditional learning then studying Optical ergonomic control agents (15 students)	Traditional learning then studying Optical ergonomic control agents (15 students)
Traditional learning 15 students	Traditional learning 15 students

The process of teaching website design skills to all students was done through the lecture method and an electronic learning environment based on the learning management system Moodle, and half of the experimental groups were taught the content of the visual ergonomic control factors through the acceptance and comfort of the human eye with the design elements (color - writing - mass and space). -Drawings and pictures that make up the website he designs. This content was not presented to the other experimental groups.

The cognitive level of the research sample was confirmed and the homogeneity and equality of the four experimental groups was ensured by applying statistical analysis (ANOVA) to the scores of the pre-achievement test with regard to the content of the course for designing websites. The result of the analysis was that there were no statistically significant differences, as the results appear in Table 2, which means that The level of knowledge of the educational content is the same for all experimental groups, and any differences that appear after the experiment are a result of the influence of the independent variables.

Teaching methods

Various educational design models were reviewed to choose the best stages for conducting the research experiment, including the analysis, design, production, evaluation and application stages. This is to study the characteristics of learners, formulate objectives for scientific content and activities, and implement the research experience

The teaching for the four experimental groups was based on the system of lectures and practical explanation of website design skills, and the learning management system Moodle was used to display digital content to explain the content and any other activities during the teaching process that took place during an entire semester of the e-learning course.

One experimental group was taught with a visual learning method and a second experimental group was taught with an audio learning method for the content of the visual ergonomic control factors for the design elements (color - writing - mass and space - drawings and images) that make up the websites that the student designs, through lectures and videos on the learning management system.

If this research is applied to website design, visual ergonomics means the extent to which the eye of the recipient/user accepts the appearance of the website from an aesthetic point of view, while achieving the functional aspect of ease of browsing and receiving the greatest amount of information in a way that is interesting to the target group and without eye strain.

In the electronic learning environment, videos were uploaded to explain the skill of designing websites

for all groups, as well as videos explaining the visual ergonomic control factors for the groups specified for the experiment, and understanding interactive tools such as dialogue rooms, chat, forums, and groups in order to facilitate cooperation between students within the electronic learning environment.

Fig 1: Learning Environment.

Data source and collection

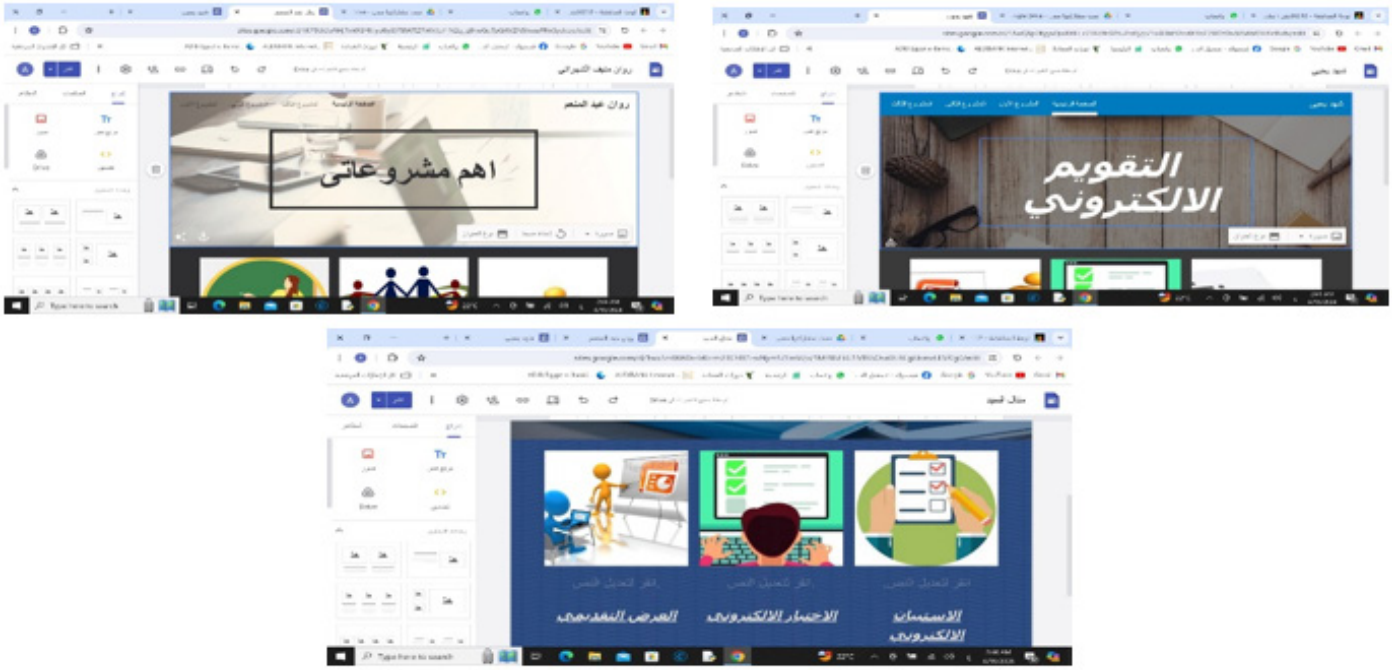
The VARK questionnaire was applied to all 200 students in the study group with the aim of dividing the learners according to the learning style (visual - auditory) and obtaining the required research sample of 60 students. The questionnaire consists of 16 questions. The learner chooses the answer that explains his preferred choice, and he can choose more than one answer. If the single answer does not match his sensory perception or the question that does not apply to you is left unanswered, using the VARK questionnaire score chart to find the learning style that matches the answers and calculate the total scores for each of the styles (visual - auditory - reading and writing - motor), and then the Choosing a sample for the research experiment from the top 30 students who obtained high scores in the learning style (visual) and the top 30 students who obtained high scores in the learning style (auditory).

An achievement test related to the website design skill was applied to the four experimental groups. The scores for this test were monitored, analyzed, and the reliability and validity of the assessment tools were tested. After implementing the research experiment according to the experimental design in Table 1, the post-achievement test was applied and the performance observation card for the website design skill was applied, and a scale of One to five to measure the level of skill performance, and to monitor and analyze those scores with the aim of demonstrating the impact of the current research variables.

Experimental method

To ensure control over the research experience, one of the researchers in this study taught all the students, who is the professor of the e-learning course, in which he explains the skills of designing websites. The students are required to attend lectures, enter the e-learning environment, present the required activities, and take an achievement test on them. The students were divided into four. Groups According to the design of the research experiment, each two groups are taught together in the specified manner.

The electronic environment designed with the Moodle learning management system allows students to log in and register for the required course using the permissions (username - password). The use of the electronic environment was explained to students and how to display and submit activities on it for evaluation.



Data analysis

The statistical analysis program SPSS was used and the statistical method one-way analysis of variance (ANOVA) was used in the pre-achievement test scores to verify the homogeneity of the experimental groups for the research, and the statistical method was used two-way analysis of variance (Two-Way ANOVA) in the post-achievement test scores and fluency scores to note performance. To verify the research hypotheses and determine the effect of the independent variables at a statistical significance level of 0.05

Results

Pre-evaluation of students' level of website design skills.

A pre-achievement test was applied to all the research sample for website design skills with the aim of pre-evaluating the educational level of the students before entering the research experiment, and to verify the homogeneity of the experimental groups before the start of the experiment. As shown in the results of Table 1, it reveals the differences between the students' scores in the pre-achievement test. Website design skills.

The results in Table 1 show the differences between the average scores of students in the four experimental groups with regard to cognitive achievement related to their skills in the practical aspect. Identifying and controlling variables, formulating hypotheses, interpreting data, and students' scientific skills were all not statistically significant at the level of (0.05) (**α** = meaning that all students participating in the research experiment were homogeneous and had equal abilities in website design skills before they were exposed to the experiment.

Table {1} : ANOVA of Differences between students' scores on the pre-test

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9.196	15	.613	.410	.968
Within Groups	65.804	44	1.496		
Total	75.000	59			

Post-evaluation of students' website design skills

Post-evaluation was applied to determine the differences between the level of students participating in the experiment in the four groups with regard to website design skills, and the statistical analysis method "two-way analysis of variance" was used between the groups to identify the significance of the differences between the learning style (visual/audio) and the significance of the differences between the factors Visual ergonomic control (traditional learning and then studying the factors of visual ergonomic control/traditional learning only), as

well as measuring the interaction between each of the research variables and ensuring that there are significant differences between them for the four experimental groups.

Results related to the cognitive achievement of website design among students according to the research variables. To verify whether there were statistically significant differences between the students' cognitive achievement, a two-way analysis of variance was used. The results are shown in Table 2

- There are statistically significant differences at 0.01 for the learning styles variable (visual - auditory) in favor of the groups with the visual learning style, with the highest average score of 41.53. The results are shown in Table 3
- There are statistically significant differences at 0.05 for the ergonomic control variable (visual ergonomic control - traditional learning method) in favor of the groups that studied ergonomic control factors, with the highest average score of 43.33. The results are shown in Table 4
- There are statistically significant differences at 0.05 for the interaction between the research variables, learning methods and ergonomic control, in favor of the highest average scores among the experimental groups, which is the group that studied ergonomic control factors with the visual learning method with an average score of 45.13, as it was more effective in enhancing and raising cognitive achievement. The results are shown in Table 5

Table {2): Two-way analysis of variance of Between-Subjects Effects

Integrated science process skills	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	518.850a	3	172.950	17.734	.000
Intercept	99308.017	1	99308.017	10182.951	.000
Ergonomic	421.350	1	421.350	43.205	.000
Learning style	43.350	1	43.350	4.445	.039
Ergonomic * Learning style	54.150	1	54.150	5.552	.022
Error	546.133	56	9.752		
Total	100373.000	60			
Corrected Total	1064.983	59			

Table {3): Average achievement scores in Ergonomic

Ergonomic	Mean	N	Std. Deviation
Ergonomic	43.3333	30	3.03239
No Ergonomic	38.0333	30	3.60539
Total	40.6833	60	4.24860

Table {4}: Average achievement scores in Learning style

Learning style	Mean	N	Std. Deviation
Visual	41.5333	30	4.90414
audio	39.8333	30	3.34338
Total	40.6833	60	4.24860

Table {5}: Average cognitive achievement scores for research groups

VAR00002	Mean	N	Std. Deviation
Ergonomic & Visual	45.1333	15	1.88478
Ergonomic & audio	41.5333	15	2.92445
No Ergonomic & Visual	37.9333	15	4.30061
No Ergonomic & audio	38.1333	15	2.89992
Total	40.6833	60	4.24860

Results related to students' website design skills according to the research variables.

To verify whether there were statistically significant differences between the students' skill performance, a two-way analysis of variance was used. The results are shown in Table 6

There are statistically significant differences at 0.01 for the learning styles variable (visual - auditory) in favor of the groups with the visual learning style, with the highest average score of 130.53. The results are shown in Table 7

There are statistically significant differences at 0.01 for the ergonomic control variable (visual ergonomic control - traditional learning method) in favor of the groups that studied ergonomic control factors with the highest average score of 125.93. The results are shown in Table 8

There are statistically significant differences at 0.01 for the interaction between the research variables, learning methods and ergonomic control, in favor of the highest average scores among the experimental groups, which is the group that studied ergonomic control factors with the visual learning method, with an average score of 136.46, as it was more effective in enhancing and developing website design skills. The results are shown in Table 9

Table {6}: Two-way analysis of variance of Between-Subjects Effects

Integrated science process skills	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4883.400a	3	1627.800	23.905	.000
Intercept	901355.267	1	901355.267	13236.686	.000
Ergonomic	3808.067	1	3808.067	55.923	.000
Learning style	680.067	1	680.067	9.987	.003
Ergonomic * Learning style	395.267	1	395.267	5.805	.019
Error	3813.333	56	68.095		
Total	910052.000	60			
Corrected Total	8696.733	59			

Table {7}: Average scores of students' skills in Ergonomic

Ergonomic	Mean	N	Std. Deviation
Ergonomic	130.5333	30	9.57271
No Ergonomic	114.6000	30	8.77143
Total	122.5667	60	12.14093

Table {8): Average scores of students' skills in learning style

Learning style	Mean	N	Std. Deviation
Visual	125.9333	30	13.15932
audio	119.2000	30	10.16213
Total	122.5667	60	12.14093

Table {9}: Average student skill scores for research groups

VAR00002	Mean	N	Std. Deviation
Ergonomic & Visual	136.4667	15	6.11633
Ergonomic & audio	124.6000	15	8.77334
No Ergonomic & Visual	115.4000	15	9.14018
No Ergonomic & audio	113.8000	15	8.62886
Total	122.5667	60	12.14093

Discussion

The preceding analysis has provided a comprehensive exploration of the impact of visual ergonomic control elements and learning methods on developing website design skills among educational technology students, This discussion aims to synthesize and interpret the findings, shedding light on the implications of the results, the effectiveness of visual ergonomic control elements, and the potential avenues for future research and interventions, By critically examining the statistical outcomes and considering the broader context, this discussion seeks to contribute to the understanding of how visual ergonomic control elements and learning methods are developing website design skills, providing valuable insights for educators, researchers, and practitioners in the field of education.

The main aim of this study was to evaluate the effectiveness of visual ergonomic control elements and learning methods on developing website design skills among educational technology students, The process of teaching website design skills to all students was done through lecture teaching and an electronic learning environment based on the learning management system Moodle, and half of the experimental groups were taught the content of the visual ergonomic control factors through the acceptance and comfort of the human eye with the design elements (color - writing - mass). And the space - the drawings and pictures) that make up the website that he designs, Various educational design models were reviewed to choose the best stages for conducting the research experiment, including the analysis, design, production, evaluation and application stages. This is to study the characteristics of learners, formulate objectives for scientific content and activities, and implement the research experience, The results of the research found that students with a visual learning style and the use of ergonomic adjustment factors are more effective in enhancing students' website design skills. This is due to the fact that effectively meeting the user's needs is a primary goal of the visual design of a website, ensuring ease of interaction with the site's interactive interface. This includes facilitating text readability, contrast, color differentiation, and image distinction. Therefore, good visual organization of website content not only makes it easier for users to find necessary information but also significantly increases the likelihood of them staying on the educational site longer and completing the targeted actions.

The visual ergonomics in this research focus on how well the learner's eye accepts the design of the website from an aesthetic perspective, while also achieving functionality in terms of easy navigation and delivering the maximum amount of information in an engaging way for the target audience, without causing eye strain. Therefore, we find that color is a fundamental element in design and holds a special importance that differs from that of any other design element. Visual perception primarily relies on color, as it is the basic unit for acquiring visual information. Additionally, an individual's mood and emotions are influenced by colors. Researchers have suggested that color, as one of the ergonomic control elements, can be used to process information in a way that aligns with the learner's comfort and impressions , Color contrast comes as one of the most important ergonomic control elements to regulate learning performance. It helps to ensure the appropriate level of color brightness between the text and the color palette used on the website pages. This consideration is crucial for enhancing readability and overall visual comfort for the user, Photographs, charts, and illustrations are essential for good design. Their purpose in this research is to enhance and refine learners' visual perception. They also help students develop and transfer their knowledge and skills. Pictures and charts are of great importance in facilitating learning rather than limiting knowledge and perception, and the semantic ambiguity of some concepts and facts, Choosing good texts that are appropriate for educational objectives, with different colors, sizes, and types, in a way that matches the background color and other elements on the screen, supports the learner's experience and allows for better reception of visual information. To achieve a harmonious and consistent appearance, there must be a balance between color, design, and image in websites. Furthermore, the element of balance was used as one of the ergonomic control elements in this research to judge the quality of the website in terms of eye comfort and the user's ability to continue browsing and navigating, because the lack of balance causes eye fatigue and makes it unable to continue.

The results of this study are consistent with the study of (Choppin, McDuffie, Drake, & Davis, 2018) Which holds that a good visual organization of website content not only makes it easier for users to find the necessary information, but also significantly increases the likelihood that they will stay on the site for a longer period and perform targeted actions.

The study by Hafizah, 2017 Abdullah Ali points out the importance of visual elements in designing an

educational website, most web designers agree that design elements are very important in web design. Fernando Moreira da Silva Cristina Pinheiro's study(Pinheiro & da Silva, 2012), Which believes that implementing design controls and a visually accessible work environment will be effective and easier on the eyes of website users.

This is supported by (Mayer, R.E.) the principles of multimedia learning and their relationship to cognitive load theory, which considers the crucial role of the image in good understanding of oral and written text.

Conclusion

In conclusion, this research illuminates the profound influence of the visual ergonomic control elements and learning methods on developing website design skills among educational technology students, The current research relied on an experimental design to demonstrate the effect of the two independent research variables (visual ergonomic control factors - learning style) on developing learners' website design skills. The students were divided into four experimental groups of 15 students each, by classifying the students into two categories of learning styles (visual). - Auditory), and each of the previous learning methods is divided into two categories according to the use of (visual ergonomic control - the traditional learning method), The teaching for the four experimental groups was based on the system of lectures and practical explanation of website design skills, and the learning management system Moodle was used to display digital content to explain the content and any other activities during the teaching process that took place during an entire semester of the e-learning course. One experimental group was taught with a visual learning method and a second experimental group was taught with an audio learning method for the content of the visual ergonomic control factors for the design elements (color - writing - mass and space - drawings and images) that make up the websites that the student designs, through lectures and videos on the learning management system. The results of the research found that students with a visual learning style and the use of ergonomic adjustment factors are more effective in enhancing students' website design skills.

This research ultimately concludes that by using these ergonomic controls, the website becomes more attractive to the user and more pleasing to the eye over a long period of use. Using these controls to create content not only enhances the effectiveness of the website's work environment, but also significantly improves the overall user experience, which contributes to achieving the goals.

Recommendations and Further Research

Several recommendations are put forward for teachers, institutions, and researchers. The research recommends enriching the content of website design with the technical aspect based on ergonomic control elements, as well as focusing on developing the technical and aesthetic awareness of website designers and developers, and also providing designers and developers of educational websites with ergonomic control elements, which works to improve the design performance experience of educational websites.

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Conflicts of Interest

The author declares no conflict of interest.

Author Contributions

All authors contributed to the research of the literature, collection of data, analysis, and interpretation of the collected data.

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