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## E-learning Visual Design Elements of User Experience Perspective

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### A B S T R A C T

The visual elements play an essential role in E-learning utilisations that impact the effectiveness of the learning users. That requires highlighting the effect of new elements of E-learning on the learning outcomes of students as well as users. The study was carried out in two phases. In the first phase, a literature review was conducted to identify the most relevant studies on the subject. This paper investigates empirical identification and examines both E-learning text and non-text related to the category of visual materials. The user experience design perspective covers literature surveys, interviews, and questionnaires. Research has been done on the types and functions of the visual elements of E-learning. Therefore, based on the existing E-learning Levin visual model elements, including "organisational", "descriptive", "interpretative", "deformable", "decorative", and "social", distinguish the correlation degree of each element with learning content and persistence. The result shows better user satisfaction enhancement and promotion of E-learning's learning effectiveness and persistence. In addition, from the perspective of user experience, it is found that social elements are the potential needs of users, and sociality is one of the characteristics of digital learning.

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## 1. INTRODUCTION

Due to recent coronavirus (COVID19), E-learning is gradually spreading to various types of teaching. Based on the rapid development of digital technology, the application scenarios of E-learning are becoming more and more extensive. The visual seat is the first human sense, and the suitable visual elements are closely related to the learning effect and learning durability of E-learning. Many studies attempted to classify visual materials according to morphology. Digital visual materials are kind of learning materials used from traditional textbooks to modern computer learning environments [1]. Visual materials can change a long several dimensions, such as authenticity, dynamics, and dimensional changes [2]. A large number of empirical studies have shown that the combination of text and graphics stimulates deeper processing than using text alone for learning, because it requires users to integrate information into different environments [3-5]. The image materials in digital visual materials are usually not independent, but they are combined with additional sources of information such as text. The information from the visual representation needs to be integrated with the information from the text to form a comprehensive and coherent mental model of the content [6]. Therefore, the key issue in using visual displays in learning is how to combine visual information with other types of external representations. Although digital visual data can show the learning effect of E-learning, in fact, users have certain deficiencies in visual reading when performing E-learning [7]. The emergence of E-learning has provided many positive results in terms of learning methods. The improvement of the visual elements displayed on the screen will create a dynamic and happy environment which increase user satisfaction [8]. Investigations show that not all visual materials can have a positive effect. Visual expression is the primary way of expressing digital learning materials, and if used improperly, it may have negative effects. Although E-learning provides a variety of visual materials, from texts, static pictures to dynamic videos, etc., expanding the scope of knowledge acquisition. Also, users encounter difficulties in reading and learning digital learning materials [9]. Therefore, whether the use of visual elements in E-learning is reasonable directly affects the learning experience and learning effects of E-learning users. Also, it affects whether learners can persist in using E-learning. The paper used interviews and questionnaire survey to show the users' needs of sociality are essential

elements of E-learning. In addition, adds social elements to form a new visual element based on the original Levin visual elements. The result shows that six major elements of E-learning vision that meet the needs of the times and the potential needs of users. The theoretical basis of visual design model can help E-learning developers and provide users with reasonable and systematic visual information.

## 2. RELATED WORK

Recently, with the development of network-based information and communication technologies, the emergence of electronic learning strengthened the trend of the entire society to pursue efficiency. Digital learning reduces the cost of cross-regional learning and increases new ways for users scattered across the country to learn. Initially, management emphasized the importance of digital learning, since this term was first used in corporate education [10]. At present, E-learning is gradually becoming common in the field of school education. In addition to e-learning, there are various terms related to E-learning education, such as distance learning, digital learning, online education, online learning, and web-based training. Since 2000, based on the maturity of digital technology, a large number of scholars have begun to pay attention to E-learning [11]. A study investigated by [28] the prevalence of depression, anxiety, and stress symptomatology among Lebanese university students during the COVID19 Quarantine. Lebanese University attracted 517 students. During the quarantine, university students in Lebanon participated. Meanwhile, [29] presented a Meta-analysis explored e-learning users' attitudes and behavioral intentions. Explore key determinants of users' attitude and behavioral intention to adopt e-learning using technology acceptance and innovation diffusion theories. This model can be used to better understand e-learning adoption, according to the results. The moderator analysis shows that subjective norms and self-efficacy are more important in collectivistic cultures, while perceived usefulness is more important in individualistic cultures. As shown by [30] developed the design elements which help create high-quality, cost-effective materials, through presented six design elements namely (activity, scenario, feedback, delivery, context, influence) by contextualizing them with examples from an e-learning initiative, they can be effectively used. Subsequently E-Learning Successful Aspects was created by [31] to identify the critical elements of E-learning based on the perspectives of 120 students, and

the results revealed that there are ten elements to ensure successfulness of E-learning which are ease of use, appearance, linkage, structure and layout, information, reliability, efficiency, support, communication and security. In [32] Deliberated gamification's development phases and applicability for e-learning systems. e-learning uses gamified design features. Where, the students who enrolled in the gamified version of the online module achieved greater learning success. From the context of international development, the definition of E-learning in different periods is shown in Table 1.

**Table1**

Concepts of E-Learning in different periods

Reference	The concept of E-Learning
Urdaan & Weggen [12]	Methods of using the Internet, intranet, satellite broadcasting, audio, video tape, CDROM and other electronic media to convey learning content
Rosenberg [13]	Computer-based learning, network-based learning, and virtual lectures utilize network technology that conveys various solutions to improve learning effects, including knowledge management or electronic technology support.
Berry [14]	Digital learning includes: effective, global, entertaining, interactive, continuous development, sound education, exciting, affordable, expensive, user-centric,
Masie [15]	Need to know, enhance, measurable, timely, collaborative, accessible, reliable e-learning and distance education will become any teacher, educator
Bates, [10]	An important tool for trainers or administrators who want to ensure that they provide a learning plan that suits the needs of users.
Robert et al. [16]	Ability, learning and training are broadly defined and placed in use various learning technologies to design, deliver, select, support, extend and tutor learning.
Garrison, [17]	Discussion of social media and mobile learning applications and other emerging technologies in today's classrooms
Clark , Mayer [18]	Effective e-learning consists of three goals: the goal of education, the user's prior knowledge and the educator's environment.
Al-Samarraie et.al. [19]	Information quality, task-technical fit, system quality, utility value, and usefulness-affecting users' continuous satisfaction with e-learning

Urdaan & Weggen [12] propose E-learning which can be seen from the above development context. They defined E-learning as a method of using the Internet, satellite broadcasting, audio, video tape, CDROM and other electronic

media to convey learning content. Garrison, [17] proposed new technical discussions on social media and mobile learning. Al-Samarraie et.al. [19] are concerned about user satisfaction with learning. With the development of digital communication technology, the development of E-learning has shifted from the initial research on technical hardware and software technology to human-centered research focusing on the user's environment, satisfaction, and emotional needs. This is in line with the human-centered design development trend of HCD (Human Centered Design) in the experience age. In order to determine the e-learning digital learning materials from the user's point of view, the biggest difference between E-learning and traditional teaching is that the process of user learning and cognition shifts from hearing-based to visual-based. The innovation of information technology has changed the way of knowledge dissemination and learning cognition: auditory dominance-transformed into visual dominance. Previously, digital equipment was widely used in teaching, the teacher was the leader of the course, and students listened to the teacher to learn. The teacher's blackboard writing and printed materials are the main visual elements in the teaching process. With the widespread application of TV monitors and projectors, digital courseware has gradually replaced teachers' blackboards and even textbooks. In past time, the digital equipment and students mainly rely on visual elements to guide the implementation of teaching activities. Therefore, visual elements have regained a dominant position in E-learning. Digital data are the main data form for students to obtain teaching information. **(1)** In the learning process of E-learning, it mainly mobilizes three of the five human senses, namely, sight, hearing and touch. As the main sense, vision guides users to perform actions. Hearing is mainly presented in spoken text, music and sound effects. The sense of touch is related to the way users use electronic devices. Among them, visual materials are the most important part of digital learning materials. Good visual effects in providing potential benefits for learning. Research on visual elements by some researchers has shown that visual memory and recall are better than ordinary textual memory [18, 20]. Appropriate visual effects can arouse readers' interest, curiosity and motivation [21]. Since vision is the most important sensory of the experienter during E-learning, the structure of visual design elements plays an important role in the design of E-learning, which will directly affects the learning effect and experience of the users. **(2)** As a method of classifying visual data functions are mostly used five E-learning visual design elements proposed. The five categories classified in [22,

23]. Including decoration, feature description, organization, interpretation and deformation, as shown in Fig 1.



**Fig 1** Five E-learning visual design elements proposed by Levin.

Decorative visual materials are used to make the course more attractive and stimulate internal motivation which they are not directly related to the content of the course. Feature descriptive visual materials can be used to produce information more specifically, helping to deliver information quickly and easily. Organized visual data can help users understand the structure, series, levels of information and unify its information. To provide users with an overall learning perspective and to help users see the diagrams of the relationships between various elements can be called organized visual data [24]. Interpretive visual data can help users understand difficult and vague content. Generally speaking, explanatory visual materials help to better understanding the information of the text. Distorted visual data can better remember the information. It can be understood here that as visual materials used to enhance information. In the currently used E-learning scenarios that most of them have the above 5 points. **(3) E-learning visual materials** are a type of non-verbal communication. Table 2 shows classified multimedia language and non-verbal elements [25-27]. The language is divided into two forms: oral text and printed text. The specific manifestation is video. Text and other forms are displayed in digital learning materials.

**Table2.**

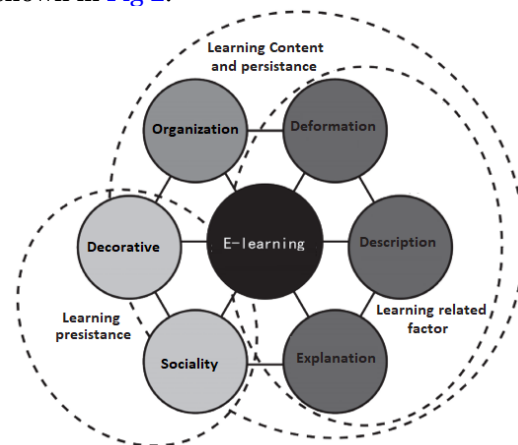
Classification table of E-learning learning materials

	Types	Notes
Text	Printed	Language and text of webpage screen and real-time video, or synthesized speech, etc.
	spoken text	
Non-Text	Fixed graphics	Drawings, photos, illustrations, maps, charts, roads, rankings, animations, etc. of pages or screens
	dynamic graphics	

Particularity the Non-verbal communication types include facial expressions, gestures, paralinguistics such as loudness or tone of voice, body language, proxemics or personal space, eye gaze, haptics (touch), appearance, and artifacts. Thus, Non-verbal in E-learning learning materials can be classified into two categories: fixed images and dynamic images. The specific content includes paintings, photos, illustrations, maps, charts, rankings, animations and other forms.

**3. PROPOSED MODEL**

In order to set the proportion of visual elements in E-learning more scientifically, this research conducted desktop interviews on the degree of correlation between visual elements and learning content. Forming a new design framework for the six elements of E-learning. Based on the correlation between the six visual elements of E-learning, learning content and learning persistence. A hexagonal model of E-learning visual design elements are formed, as shown in Fig 2.



**Fig 2.** The proposed E-learning visual design model

The six-element model of E-learning visual design is divided into three dimensions from its relevance to learning. **(1) Elements closely related to learning content:** 1. Interpretative visual elements: In order for learners to

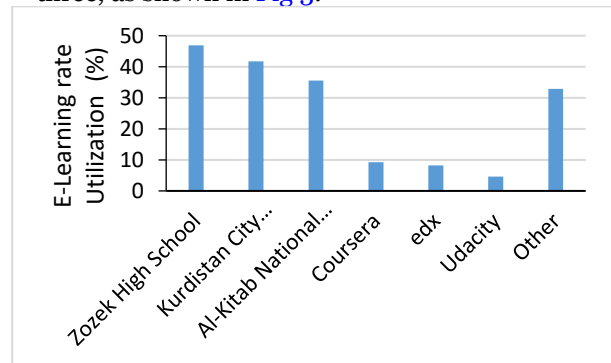


understand the content of knowledge information, use visual means to interpret the knowledge information. **2.** Descriptive visual elements: Use visual representation to describe knowledge information. **3.** Strengthen deformed visual elements: use visual static or dynamic expressions to strengthen certain essential knowledge points and deform them to achieve the purpose of attracting the attention of learners. **(2) Elements related to learning content and continuity of learning:** Organizational visual elements: to help users understand the structure and level of the overall learning information, provide users with an overall learning perspective and help users see diagrams of the relationships between various elements can be called organized visual data. **(3) Elements related to the persistence of learning:** **1.** Decorative visual elements: Considering from the user's hobbies, habits and emotions, although decorative visual content cannot directly relate to learning knowledge, it can make users happy and attract users to continue Learn. **2.** Social visual elements: Based on the rapid development of the Internet and people's growing spiritual and cultural needs. People's needs for self-expression have gradually increased. Becoming one of the potential experience needs. In summary, the six elements of the three dimensions are necessary elements of E-learning visual design.

#### 4. RESULT AND DISCUSSION

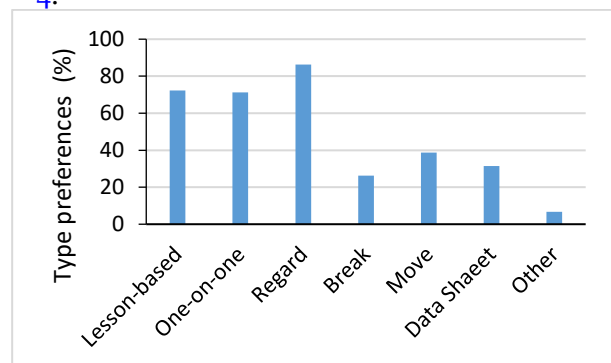
This paper uses interview method and questionnaire survey method to investigate users. From the perspective of E-learning users' own experience to look for their potential needs when using E-learning. Also, to understand what affects these needs have. Through interviews with 10 E-learning users, it is found that in the learning process of E-learning, the users pay more attention to whether they can persist in learning during the learning process than the content of the learning. For example, some websites or APP platforms can post check-ins on Social Networking Services (SNS) after learning to promote users' continuous learning every day. There are also games to maintain the enthusiasm of learning through pre-kindergarten (PK) to Senior year in high school. with friends who are studying together. Interestingly, although social content is not directly related to learning content. Respondents are generally interested in social elements and believe that social elements are an important driving force for continuous learning. In the interview process, the display form of the social visual elements proposed by the users mainly includes the following content: display learning level, display learning identity, display learning time, display mutual comments, display virtual class group status, display teacher evaluation and display

Personalization, etc. In order to have quantitative evidence, this research conducted a survey of 342 people by issuing questionnaires online. Among them, there were 332 valid questionnaires, with 123 males and 209 females interviewed. In terms of age distribution, 113 undergraduate students aged 18-21 accounted for 33.93%, and 158 people aged 21-31 accounted for 46.87%. The degree of undergraduate degree is the highest, accounting for 55.56%, followed by master and doctoral students, 18.92% and 12.01%, respectively. Among 332 people, 273 people have used E-learning. Among them, Zozek High School, Kurdistan City Primary School, and Al-Kitab National University are among the top three, as shown in Fig 3.



**Fig 3.** Utilization survey of E-learning platform

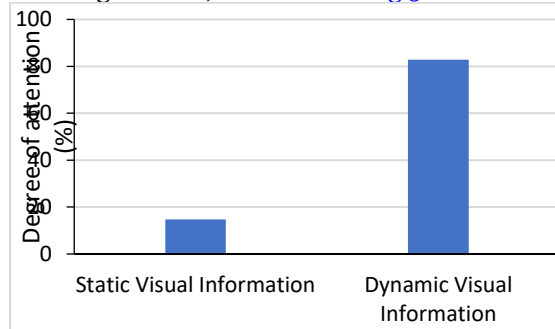
Type of preference shows that 71.37% of users believe that they are more careful when learning printed materials and faster when reading digital materials. When studying E-learning, the interviewees considered that the primary forms of visual materials were text, pictures, and videos. Video elements accounted for 86.23%, which is the highest value among other types of visual materials, as shown in Fig 4.



**Fig 4.** Type preferences of E-learning visual materials

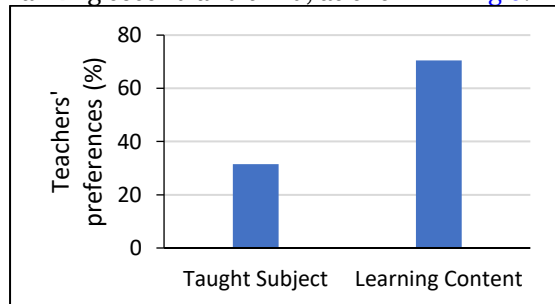
Where 82.87 of respondents think that dynamic visual elements are more attractive. In addition, 75.32% of users believe that dynamic visual data makes people concentrate. This shows that in the E-learning visual learning materials and dynamic images have attracted the attention of users. Therefore, the dynamic images related to

the text will be better describe and explain the teaching content, as shown in Fig 5.



**Fig5.** The degree of attention of visual materials

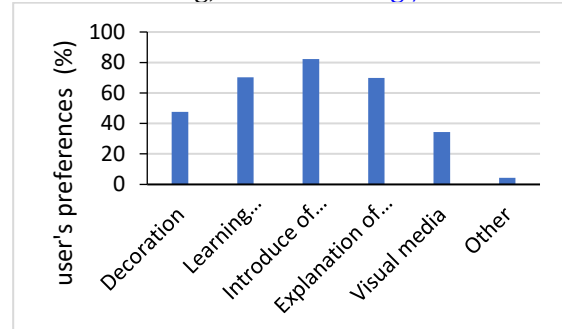
When users watch videos, 34.32% of respondents tend to focus on learning content in video content (teaching videos composed of text, images, animation, etc.), and 31.46% of respondents tend to focus on teachers as the main content of the video. You can watch the live teaching video dictated by the teacher. It can be seen from this that in the course of E-learning, the importance of teachers is gradually being diminished compared with traditional teaching, as shown in Fig5. Where the visual elements of E-learning, 82.23% of the respondents believed that the visual elements of the structure and level of learning content are the most important. Secondly, the explanations of learning content accounted for 69.83% and feature descriptions accounted for 70.36%, ranking second and third, as shown in Fig 6.



**Fig 6.** Teachers' preferences in E-learning teaching

During the interview, some users raised questions about the social aspect in the E-learning process. Through interviews, social visual elements include the following content: display learning level, display learning identity, display learning time, display mutual comments, display virtual class group status, display teacher evaluation and display personalization, etc. 79% of respondents want to see the visual elements of sociality. Among them, the social visual elements that the interviewees want to see in learning are: 37.46% of the interviewees want to show their personal learning time to the public; 36.84% of the interviewees want to show their learning level; 33.13% of the interviewees The author hopes to

show the teacher's evaluation information on his own learning, as shown in Fig 7.



**Fig 7.** The user's preference for the type of visual elements

From the above survey results, current E-learning users have a potential demand for social visual elements. With the development of Internet communication technology and E-learning gradually embodies new characteristics. For instance, Al-Kitab National University allows users to develop from terminal independent learning to Internet-based virtual class co-learning. Here is a social factor, as shown in Table 3.

**Table3**

Analysis of the social visual elements of the four E-learning platforms

Location	Zozek High School	Kurdistan City Primary School	Coursera	Al-Kitab National University
Learning factors				
Learning identity	**	*	*	*
Learning level	**	**	*	*
Virtual class	***	*	***	*
Complement each other	*	*	**	*
study-time	**	**	***	*
Teacher evaluation	**	*	**	*
Personalization	/	/	***	/

key preference indicators: Good \*, better \*\*, best \*\*\* and not applicable / N/A

This study selects three well-known E-learning platforms in Iraq: Zozek High School, Kurdistan City Primary School, Al-Kitab National University and COURSERA; the largest E-learning platform in Europe and United States, as a case study. It is found that these four E-learning platforms have the above most social elements. People have a social nature [33]. Virtual class learning leaderboards, discussion room labels, learning grade identification and evaluation grade identification etc. are all visual manifestations of E-learning's social content. These visual elements generated by social needs appear on major E-learning platforms. According to the survey results, the social element is a necessary visual element in the E-learning process. In the user's E-learning process, it not only produces human-computer interaction, but also

produces human-human interaction. Social presence is not only a factor for users to choose courses, but also an important factor for users to learn motivation and learning satisfaction. Therefore, this research believes that from the perspective of users, social visual elements are necessary elements for E-learning.

## 5. CONCLUSION

This study permitted us to determine the important aspect social and decorative, through applied all the six elements to ensure utility of E-learning. The E-learning visual design elements the visual elements in the hexagonal model are "organizational", "descriptive", "interpretative", "deformable", "decorative", and "social". The essential elements of the data, starting from the organisation and structure of learning content, as well as paying attention to the performance of the teaching process, the attention to the user's personality and social required cover various functions of visual expression in E-learning. This E-learning visual design element hexagonal model provides E-learning designers with a scientific theoretical basis in the visual design process from the perspective of user experience. Moreover, it presents a guide value of improving user satisfaction and learning effectiveness by adding both sociality and decorative capabilities. In addition, the hexagonal model can be used as a reference for E-learning design. It is believes that these elements are very important elements in ensuring successfulness of E-learning platform in higher learning Institutions, universities and Self-learning.

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