Design Approach of Hologram Tutor: A Conceptual Framework

Mohd Khairulnizam Ramlie, Ahmad Zamzuri Mohamad Ali, and Muhammad Ihsan Rokeman

Abstract—**Hologram tutor is a new approach that has potential in attracting students' attention, especially the young generation who lack interest with traditional delivery methods. In addition, the use of hologram tutor serves as an alternative strategy to deliver information in a more interesting manner, which consequently will provide new experience to the students. Nevertheless, the actual human design use of a hologram tutor may cause some inconvenience or uneasiness among students, adversely affecting students' emotion in learning. Such a phenomenon is called Uncanny Valley, which was developed through a study by Masahiro Mori in 1970, who also developed a graph to explain such a concept. Against this backdrop, this paper proposes a conceptual framework for the design approach of a hologram tutor with the main aim of enhancing students' positive emotion in learning. Essentially, this conceptual framework was developed grounded on relevant theories and principles highlighted in the current literature. Additionally, this paper suggests potential future studies to validate the proposed framework.**

Index Terms—**Character design, hologram tutor, uncanny valley, emotions, learning.**

I. INTRODUCTION

The advancement of multimedia technology is rapidly improving, especially in the field of digital animations. This eventually makes the design and development of the multimedia elements become more easier and consequently expanding its use in various fields, including in education [1]-[3]. In view of the rapid development of this technology, the need of innovating its use in the teaching and learning process has become more urgent; in order to ensure that such a process will be more attractive and effective [1], [4]. Among the innovations, specifically in the visualization and presentation aspect is hologram technology [5]. Some studies had shown that the use of human characters at various realistic levels can produce different emotional effects. For example, a study was done on video games [6], [7] and a pedagogy agent [8], stated that the use of more realistic characters may give

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users a more comfortable effect. However, there are still lacking in in-depth studies regarding students' emotional aspects when learning with realistic holographic representations as tutors. It is a very important thing to be identified because the use of holographic representations of tutors can influence the students' emotion when receiving any parts of information in the classroom. Hence the realistic level of the holographic representative needs to be examined to ensure that students are comfortable with the presence of the character. After all, the medium used is totally different from the conventional method of receiving images through screens of computers, tablets and smartphones.

II. HOLOGRAM IN EDUCATION

The word hologram originated from the Greek term 'holos', meaning an overall view [9]. In principle, a hologram consists of two light sources interacting with one another to create 3D visual [10]. In other words, a hologram is a combination of reflected 2D visuals that are projected from a display device, such as a screen or a projector that gives a 3D look [9], [11]. To date, holograms are viewed as a 3D visualization technology for future generation [12]. Moreover, a hologram technique can present objects or characters in such a way that makes it looks appealing in delivering information more innovatively to the users. In addition, holograms has been acknowledged to be highly appealing to attract users' attention, especially among the younger generation who lack interest with the traditional delivery methods [13]. Nonetheless, the use of holograms may have several negative effects on the older generation who lack experience in using current technology [14].

Admittedly, the use of a holographic medium is not restricted to specific aspects as it encompasses multiple disciplines such as education, advertisement, and entertainment among others [15]. Viewed from the educational standpoint, holograms have a unique ability to attract the interest and attention of users and can make the information processing in the user's memory to be more effective [16], [17]. Furthermore, the use of holograms will be able to influence the teaching and learning condition [18]. In this regard, holograms have strong potential to serve as an effective instructional medium to help the teaching and learning process. Taking cognizance of its many benefits, many efforts have been put in place to explore its educational attributes that can be applied in teaching and learning [9]. Given that the use of holograms in the educational realm entails detailed studies [19], researches on holograms must focus on the design principles that can further enhance its effectiveness in the teaching and learning process. Despite

having a host of educational benefits, such a focus is essential to deal with potential pitfalls, such as the acceptance of this novel tool by users of various ages [14]. Fig.1 shows a hologram based on a real human character [5].
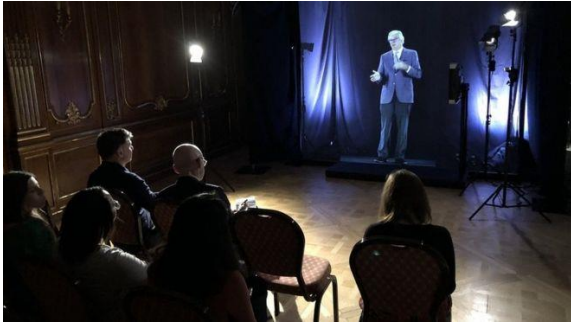

Fig. 1. A real human character hologram.

III. EMOTIONS AND ACCEPTANCE

In general, emotion in learning is an internal feeling experienced by students during learning [20], [21]. In principle, emotion can be divided into two different categories, namely positive and negative emotion [20], [22]-[25]. Positive emotion experienced by students during learning is the feeling of enjoyment, excitement, interest, and accomplishment.

In addition, the emotion experienced by students can influence their level of motivation during learning sessions [26], [27]. In particular, positive emotion experienced can raise students' motivation; in contrast, negative emotion can lower their motivation that demotivates them to continue engaging in learning [20], [23], [28].

Taking into consideration of such emotion, it is imperative to carry out studies to identify the ideal character design for hologram tutor. This, to ensure that positive emotion can be realized in students' learning sessions. To date, most studies carried out mainly focuses on the effect of emotion induced by the character design in the field animation [29]-[32] and computer games [9], [10]. Thus far, studies focusing on the effect of the character design on students' emotion are seriously lacking or almost non-existent for hologram tutor. Nevertheless, the research findings of studies on animation and computer games suggest that the diversity of appearance and personality of a character design can have a profound impact on users' emotion. Surely, such a revelation needs to be given a strong emphasis in the design process of characters for computer applications [29], [33], including hologram tutor.

In addition to the emotional aspect, the acceptance of the use of a hologram tutor also need to be seriously considered. Such a consideration is important when dealing with the use of new technology as several factors, such as the age of users, can influence their acceptance of such technology [34]. According to Prensky [34], the age level can be divided into two categories, namely digital native and digital immigrant. Digital natives refer to the group of users born after 1990, while digital immigrants are those who were born before 1990. Nonetheless, there are other opinions stating that the difference in the acceptance of a new technology corresponds with the age of users, implying that the older the users, the

lower their acceptance of such technology [35].

Overall, this paper highlights the difference in the acceptance of new technology based on users' age. In this regard, the age difference between older and new generation needs to be taken into account in the use of a hologram tutor as a representation of a teacher in the classroom. Given that, its extensive use in the higher institutions of learning consisting of diverse students' population of various demographics, including age. More importantly, the effect of the acceptance of a hologram tutor can also influence the emotion of students in learning.

IV. THEORETICAL FRAMEWORK

In this study, two related theories were used as the foundation for the conceptualization of the proposed framework. The first was the Control-Value Theory of Achievement Emotions [36], a theory that focuses on achievement emotions with which scholars can use in analyzing the causes of emotional changes and the effect of emotions experienced in learning sessions [37]. Essentially, achievement emotions are an emotion that is directly experienced by students while engaging in learning activities and also after the completion of learning activities [20], [24], [38]. Based on this theory, achievement emotions can be divided into three different values or dimensions, namely positive or negative emotional reaction, the level of emotional activation (activating or de-activating), and the focus of objects (activities or learning outcomes) [38]. Based on these three values, Pekrun *et al*. [36] conceptualized and developed a 3-dimensional taxonomy of achievement emotions as summarized in Table I.

TABLE I: THE 3-DIMENSIONAL TAXONOMY OF ACHIEVEMENT EMOTIONS BASED ON CONTROL-VALUE THEORY OF ACHIEVEMENT EMOTIONS

Focus of object	Positive		Negative	
	Activating	De-activating	Activating	De-activating
Focus on activities	Fun	Relaxed	Angry	Bored
Focus on learning outcomes	Happy. Hope. Proud. Appreciated.	Satisfied. Relieved.	Worry. Shy. Angry.	Sad. Frustrated. Lost hope.

Based on this theory, students' learning motivation can be increased by promoting positive emotions. For instance, feeling of enjoyment when engaging in the learning activity could increase positive emotions. By contrast, negative emotions, such as bored could reduce students' motivation to engage in the learning activities [20]. As such, this theory can be referred for studies focusing on the dimension of the reaction of positive emotions and its impact on the learning motivation. Specifically, for the scope of this paper, study on the role of hologram tutor character design in enhancing positive emotions of students. Based on this theory, the appropriate character design of the hologram tutor that can optimally enhance students' positive emotions need to be identified. In addition, the hologram tutor characters that can

activate (feeling of fun) and de-activate (feeling angry) need to be categorized for students of different age levels as well.

To enhance positive emotions in learning, numerous character design approach of the hologram tutor can be studied based on Uncanny Valley phenomenon. The phenomenon explains the relationship between level of realism of a character and human's emotion [39]. In this respect, the selection of characters with appropriate level of realism needs to be carried out in the development process of the hologram tutor. An animation character with too much realism can adversely affect users' emotions and feeling of comfort as they see such a character. Clearly, mistakes made in selecting proper level of realism could cause Uncanny Valley phenomenon, which might have an adverse severe effect on users' emotional state [32].
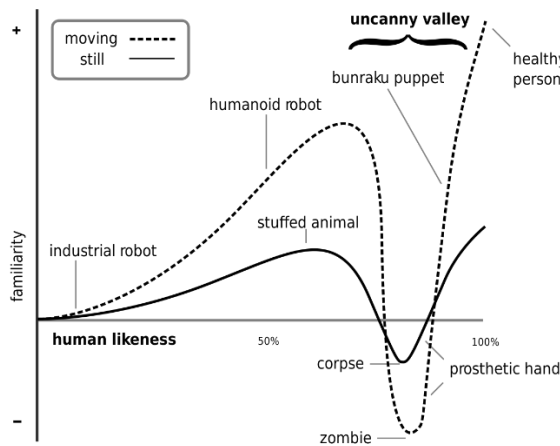

Fig. 2. The uncanny valley graph.

Clearly, a strong grasp of the Uncanny Valley phenomenon is vital in selecting the most appropriate design for the character of hologram tutor. As such, studies to examine such a phenomenon in determining the dynamic character deemed proper for the proposed hologram tutor to represent a teacher delivering his or her lessons in the classroom. As highlighted in the Mori's graph of Uncanny Valley, positive emotions increase with increasing realism of a character representing humans. However, for dynamic and static characters, the opposite is true in that users' emotions can reach a negative level when the character is in a horrible form or shape. Specifically, the level of comfort dropping as shown in the graph is called the Uncanny Valley phenomenon.

Such a phenomenon will occur when the character design approaches a realistic human, causing users to feel scared and horrible [40]. Nevertheless, the graph also shows that the level of emotions increases positively with the use of a real human character [39]. In addition, the same graph indicates that the dynamic character will be subjected to an extreme effect of the Uncanny Valley phenomenon compared to that of the static character. Thus far, hologram tutor character with different design approach has not been tested for its effects on users' comfort. Therefore, the selection of characters based on the Uncanny Valley phenomenon graph need to be further compared for hologram tutor condition. This is specifically on their impact on students' emotion in learning.

V. CONCEPTUAL FRAMEWORK

Based on the review of the literature pertaining to the relevant theories and principles of designs, this paper proposes a conceptual framework of hologram tutor character design as depicted in Fig. 3.
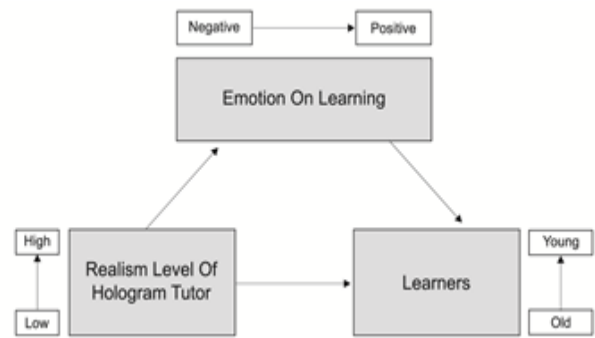

Fig. 3. Conceptual framework.

The realism level of a hologram tutor representing teacher plays an important role in determining students' emotions in learning. As such, selecting appropriate level of realism for such a representation requires careful considerations. Furthermore, the use of the hologram tutor encompasses a range of students' ages or generations, which might cause different emotion effects on such groups of students. In this regard, choosing an inappropriate realism level of the hologram tutor character may undermine students' emotions, which, according to the theory of Uncanny Valley can make them feel uncomfortable if the chosen realism is too high. This situation will disrupt the students' emotions, and at the same time will effect their motivation in learning. In particular, the realism level of a character is an important factor that needs to be given due consideration to avoid students from being uncomfortable when learning using a hologram tutor. In view of such a need, study to identify the most appropriate realism level of a hologram tutor character, which can truly represent a teacher in the classroom seems important.

Furthermore, the use of the appropriate level of realism can have positive emotional effect on students of various levels of age. Emotions in learning that are a person's inner feelings during the learning process need to be emphasized to ensure meaningful learning process happens. As such, positive and negative emotions effect need to be identified first to assist instructional designers in determining the appropriate character for the hologram tutor. Specifically, positive emotions, such as pleasure, excitement, interest, and satisfaction, can enhance students' motivation that encourages them to continue learning and receiving information more effectively. As such, the ideal character design of the hologram tutor has to be accurately identified to help enhance positive emotions, notably the state of pleasure, among students. The character design of the hologram tutor might be the primary cause of the change in students' emotions, the effect of which would have a profound effect on their learning. In particular, the level of realism of such a character that can activate positive emotions and de-activate negative emotions of students of various ages need to be categorized.

In addition, the differences in age might be one of the

factors that have a strong influence on the acceptance of such a tutor and that have a profound effect on students' emotions. The students of different age levels may have different interaction effects, making a certain group of students, especially the older generation of students, to be indifferent to the use of novel technology, such as the hologram tutor. In contrast, the younger generation of students may find the hologram tutor to be a novel tool that can deliver information more efficiently with some excitement. Given that students of the institutions of higher learning are of various age levels, it becomes the imperative of researchers and scholars to examine and analyze the interaction of the use of the hologram tutor with respect to such a difference.

VI. FUTURE WORK

In an effort to carry out this study, the researcher will conduct classes tutored by holographic characters catered to students from various ages. The researcher uses some methods to analyze the emotional impact and acceptance towards the use of holographic characters to represent tutors in classrooms. The respondents are grouped into categories as children, teenagers and adults. To analyze the acceptance level of the holographic characters, the researcher uses the User Experience Questionnaire UEQ [41] that is proven in its effectiveness. On the other hand, the emotional impact in tutorial sessions are examined through the Self-Assessment Manikin (SAM) [42] and Achievement Emotions Questionnaire (AEQ) [24]. Through the study, the effectiveness of the holographic representation of tutors for various age groups can be identified and achieved.

VII. CONCLUSION

The use of holograms in education has been proven to be effective, made evidently from previous studies. More specifically, the use of holograms as a tutor to substitute the real teacher can help in attracting students' attention and deliver information more effectively in an innovative way than that of the traditional approach. As such, design principles aspects need to be given a strong emphasis. Which, inappropriate hologram tutor character design can cause negative emotions among students, the impact of which can demotivate them to stay in learning. Against such a backdrop, studies focusing on the effect of Uncanny Valley phenomenon on students' comfort and emotions seems important. As highlighted in the proposed conceptual framework, the level of realism of the character of hologram tutor is a major issue that needs to be addressed with extreme care, especially for students of various ages who may have different interaction effects.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Mohd Khairulnizam Ramlie conducted the research; Ahmad Zamzuri Mohamad Ali grant leader and research supervisor; Muhammad Ihsan Rokeman contribution for the knowledge; all authors had approved the final version.

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