Exploration and Analysis of Multimedia Learning Experiences in Online Museums: A Visitor Study Based on Eye Tracking

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Abstract. Advances in network information technology and the generalization of multimedia learning have promoted museums to increasingly develop online exhibitions, allowing visitors to appreciate and learn about cultural artifacts with unlimited time and space. However, what kind of picture arrangement and language style is more suitable for learning remains to be further empirically explored. This study conducted a two-factor between-subject experiment combining eye-tracking, questionnaire measurements, and interviews with 54 participants to investigate the role of different picture presentation formats (integrate/separate) and text types (non-anthropomorphic/anthropomorphic) in artifact learning. It was found that subjects in the integrated form produced shorter and fewer fixations than those in the separated form, but this did not affect retention and transfer test scores after learning. Anthropomorphic texts showed shorter mean saccade amplitude and elicited more positive emotional experiences. Based on this, some design recommendations were proposed for how to improve multimedia learning in museum contexts.

Keywords: Multimedia learning, Museums online display, Text-picture presentation, Eye tracking, Visitor study

1 Introduction

Multimedia teaching and online learning have become widely utilized teaching methods as a result of the development of network technology, which has brought about a new change in the means and environment of instruction [1]. Museums, which are significant places for informal learning, are also tending to rapidly develop online exhibits. By giving viewers access to a multitude of high-quality digital images of cultural artifacts along with descriptive texts, museums are expanding the dissemination boundaries of using cultural artifacts for universal education [2].

The text-picture display is one of the basic exhibition patterns in digital museums. Since there are variations in the existing ways of artifact text-picture presentation, it is necessary to explore the differences in audience learning effects under different display methods. On existing digital museum pages, we primarily observed two distinct displays of artifact text-picture presentation (see Fig. 1 for an example): for digital images, there are integration and separation presentation formats. Integration refers to being able to view multiple artifacts on the same page at the same time. In contrast, separation refers to artifacts that are not arranged

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on the same page due to factors like image size and other constraints and must be viewed through keystrokes or sliding. As for the introductory texts for the information about the artifacts, some museum websites began to introduce artifacts using anthropomorphic texts. They allow the artifacts to "introduce themselves" in the first-person mode and in the conversational linguistic style, which differs from the general explanatory nature of the formal texts. Given the background of existing research exploring the application of certain design principles of multimedia learning in museums [3], these two modalities appear to correspond to the segmentation and personalization principles, but the specific learning effect and audience experience in the museum context remain to be investigated. Besides, the current domestic research on online museum artifact text-picture pages is dominated by theoretical discussions [4], with few studies conducting experimental research [5], especially visitor studies that incorporate eye tracking.

This study conducted an empirical study to investigate the differences in audience learning processes, outcomes, and emotions under different picture presentation formats and text types. The specific research questions were:

1. Will viewers' eye movement, learning outcomes, and emotions vary depending on the integrated/separated presentation format of artifact text-picture display?

2. Will viewers' eye movement, learning outcomes, and emotions vary depending on the text type of artifact text-picture display?

Based on the questions, a 2 (integrate/separate) × 2 (non-anthropomorphic/anthropomorphic) between-subjects design experiment was conducted. The results are expected to theoretically expand the application context of multimedia learning to a certain extent and explore more audience-friendly page design methods for museums to better realize their educational functions.

(a) (b)

Fig. 1. Examples of different text-picture displays (a) Integrated/separated presentation format (screenshot from the National Museum of China website) (b) Application of anthropomorphic texts (screenshot from the Zhejiang Provincial Museum website)

2 Theoretical foundations and related works

As pictures and texts comprise the primary medium of online museum exhibits, which can also be regarded as a multimedia environment, the Cognitive Theory of Multimedia Learning (CTML) and related design principles can provide possible guidance for museum research. The theory considers the beneficial impacts of presenting pictures and texts combined, divides the cognitive processing of meaningful learning into three basic processes: selection, organization, and integration, and proposes a series of multimedia instructional design principles accordingly [6]. Among these, two of the principles - segmentation principle (multimedia instructional information is more effective when it is presented in chunks at the learner's learning pace rather than uninterruptedly) [7] and personalization principle (multimedia messages presented in a conversational style of speech are more conducive to learning than a formal style) [8] - are more pertinent to this study. Currently, multimedia learning theory has been introduced in the museum field and certain exploratory research has been carried out. These include testing the effectiveness of multimedia principles in the context of museums using various material combinations [3], developing virtual museums based on specific design principles and evaluating their efficacy [10], and applying the theory to explain and analyze visitor behavior [12], which is of great significance to cultural heritage learning research and practice. However, the results of related design principles are not consistent [13], and specific design principles should still be empirically tested in various application contexts and themes. Moreover, there is not much research on the display pages of artifacts based on multimedia learning design principles and related paradigms [5].

The Cognitive-Affective Theory of Multimedia Learning [14] further expands the CTML. The affective mediation hypothesis suggests that affective and motivational factors influence learning by altering cognitive inputs to the learning process, indicating that there is a need to consider the important role of emotions in the learning process. Thus, the learning experience can be considered to include cognitive dimensions such as knowledge acquisition as well as non-cognitive dimensions such as emotions. Emotional design, namely, using different design elements for teaching content to stimulate learners' emotions and promote their learning [15], has accordingly emerged as a new area of interest for educational research. In general, emotional design is expected to efficiently produce a favorable impact on multimedia learning [16], and its research object has developed from graphic shapes and colors [17] to textual content [18], i.e., adding emotional words and metaphors in texts. Anthropomorphic texts can to some extent be considered as textual emotional design and have demonstrated their positive implications in areas such as biological knowledge learning [19] and tourism destination marketing [20]. But the effectiveness in the museum field or artifact display remains uncertain.

Eye-tracking technology as an immediate and non-invasive measurement method has been widely employed in various fields [21], including multimedia learning and museum fields [22]. Eye-tracking devices can record eye movements and gaze behaviors while viewing learning materials like artifacts, which thereby help explore an individual's cognitive processing. Therefore, the present study adopted this technique to explore the impact of different text-picture display methods on viewers' visual attention during the learning process. We also tested knowledge outcomes and emotions after learning, trying to refine the understanding of the whole learning experience.

3 Methodology

3.1 Participants

54 college students were randomly recruited as subjects (the quantity refers to some literature of the similar design [5]), with a total of 52 valid samples (M_{age} =23.54, female =35, male =17) after excluding data with low eye movement sampling rates. All subjects self-identified as not having expertise in cultural artifacts, with a broad distribution of majors. All were normal in color vision and had normal visual acuity or corrected visual acuity.

3.2 Materials

Ceramics and bronzes were used as experimental materials because these two categories are representative of China's existing movable cultural artifacts (e.g., of the nearly one million collections in the Palace Museum, ceramics and bronzes account for about 370,000 and 160,000 items, respectively[1]). Sixteen artifacts of each type were screened and downloaded from Chinese official museum websites. All materials were divided into 4 groups, each including an introductory text and 8 pictures, with the integrated group being the four simultaneous presentations and the separated group being the sequential presentations (see Fig. 2 for an example). The text introductions were written in two different language styles: the non-anthropomorphic group was a formal style using the third person, such as "The Li (a specific bronze shape type) is characterized by a wide opening...", and the anthropomorphic group used first-person anthropomorphic rhetoric, such as "I'm a Li. I have a big mouth and a pouch-shaped belly...".

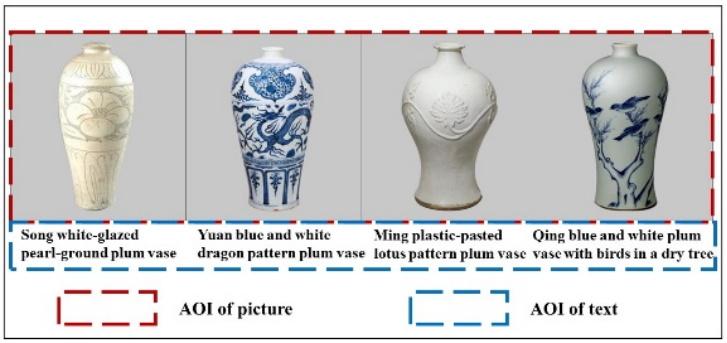
3.3 Measurements

Eye movement data. The experiment was conducted on a Tobii TX300 eye-tracker with a sampling rate of 300 Hz and a display screen of 23 inches, 1920 × 1080 resolution, 94 ppi, and 60 Hz refresh rate. The viewing page was divided into picture and text areas of interest (see Fig. 2). Fixation duration (FD), fixation counts (FC), visit counts (VC), and mean saccade amplitude (MSA), which are commonly used in multimedia learning and reading research, were chosen as indicators for the analysis. The duration and numbers of fixation can be used to infer cognitive processing load, depth and intensity of processing, interest level, etc [23]. Visit counts refer to the number of transitions between pictures and texts, which is frequently used to represent the integration process in multimedia learning research [25]. Mean saccade amplitude is defined as the average distance or breadth from the beginning to the end of a saccade and can be used to reflect the difficulty of processing material and reading efficiency[23].

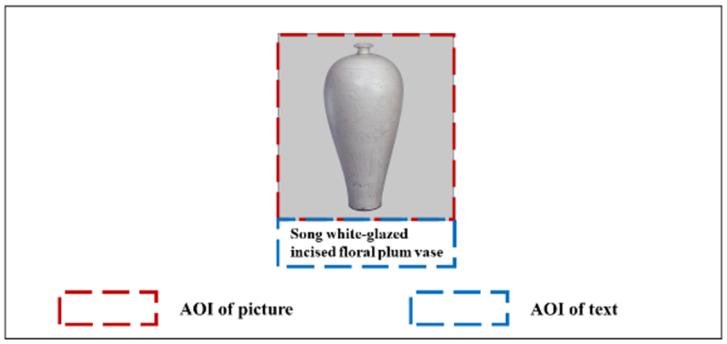
Learning outcome. The learning outcome tests included a retention test and a transfer test, both consisting of 32 four-option multiple-choice questions of artifact-related knowledge. The retention test used artifact material that had appeared during viewing, and the transfer test used new artifact material, scored 1 point per question, and had internal consistency alpha coefficients of .762 and .745, respectively. The subjects' average percent correct on both tests was calculated as the learning performance.

[1] General catalogue of the collections in the Palace Museum. https://zm-digicol.dpm.org.cn/

Emotion experience. Subjects' emotional state after viewing the material was measured using the SAM Scale (the Self Assessment Manikin [26]), a 9-point emotional scale developed by Bradley & Lang to measure a person's valence, arousal, and dominance to stimuli.



(a) Integrated form

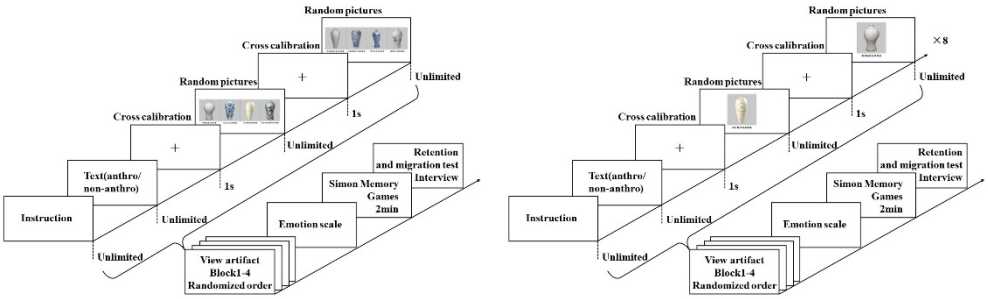


(b) Separated form

Fig. 2. Diagrams of the division of interest areas

3.4 Procedure

The experimental procedure is shown in Fig. 3. Each subject was randomly assigned to one of the four conditions. After completing the eye movement calibration to enter the viewing stage, the screen first presented the instruction, and then randomly presented the introductory texts and pictures of the artifacts to balance the order effect, and the subjects were asked to view the artifacts freely, with a total of 32 pictures to be viewed. After viewing, the subjects needed to fill out an emotional scale based on their actual feelings. A 2-minute break was then given, during which the subjects were instructed to play a game called Simon Memory Game [27] as a memory distraction. Afterward, they completed the learning outcome test. Finally, a brief interview was conducted with the subjects, which consisted of explaining their eye movement behaviors, elaborating on their perceptions and subjective sensations about different experimental conditions, and so on.



(a) Integrated form (b) Separated form

Fig. 3. Experimental flow charts

3.5 Results

3.5.1 Eye movement data

The eye movement data for each area of interest (AOI of picture and text as shown in Fig. 2) are shown in Table 1. Analyses were performed using a two-factor between-subjects analysis of variance (ANOVA).

Picture FD、*FC*、*VC*. The results showed a main effect of presentation format for all three metrics [FD: F(1,48) =15.844, P =.000＜.001, η_p^2 =.248; FC: F(1,48) =7.164, P =.010＜.05, η_p^2 =.130; VC: F(1,48) =34.751, P =.000＜.001, η_p^2 =.420], with significantly less attention paid to pictures in the integrated form than in the separated form. But the main effect of text type and the interaction effect were not significant.

Text FD、*FC*、*VC*. For text FD and FC, no significant main effect was found in presentation format and text type, but the interaction effect was significant [FD: F(1,48) =7.040, P =.011 ＜.05, η_p^2 =.128; FC: F(1,48) = 5.072, P =.029＜.05, η_p^2 =.096]. Simple effects analyses revealed that text FD (P = .025 < .05) and FC (P = .037 < .05) were significantly larger for non-anthropomorphic texts than for anthropomorphic texts in the integration condition, and that text FD (P = .011＜.05) was significantly shorter for integrated forms than for separated in the anthropomorphic condition. For text VC, there was a significant main effect of presentation format [F(1,48) =4.307, P =.043＜.05, η_p^2 =.082], with significantly fewer visits in integrated form than in separated form, but the text type and interaction effects did not indicate significance.

Introductory text FD、*MSA*. Analysis of the eye movement data for the introductory text did not reveal a significant effect on FD, but the main effect of text type on MSA was significant [F(1,48) =5.617, P =.022＜.05, η_p^2 =.105], with non-anthropomorphic texts being significantly shorter than anthropomorphic texts.

Table 1. Descriptive statistics of eye movement data

	Inte/Non-anthro M±SD	Sepa/Non-anthro M±SD	Inte/anthro M±SD	Sepa/anthro M±SD
Picture FD	73.20±47.00	134.58±46.89	59.09±38.20	99.10±50.66
Picture FC	292.00±170.60	443.15±143.21	248.85±144.73	324.23±150.24

Picture VC	63.46±21.52	90.31±26.87	47.85±15.01	91.08±20.66
Text FD	57.85±34.39	45.20±31.34	31.15±17.17	61.90±31.91
Text FC	228.46±133.63	173.92±109.09	139.69±73.56	217.15±97.42
Text VC	57.23±23.09	60.77±28.84	41.08±14.71	63.46±21.14
Introductory text FD	27.02±16.82	23.36±9.42	18.86±7.92	22.09±9.84
Introductory text MSA	4.28±.42	4.52±.94	5.07±.83	4.76±.82

3.5.2 Learning outcome

The results of learning accuracy are shown in Table 2. The results showed that the experimental conditions did not have a significant main effect and interaction on either the retention test [presentation format: $F(1,48) = 2.555$, $P = .117$, $\eta_p^2 = .051$; text type: $F(1,48) = .170$, $P = .682$, $\eta_p^2 = .004$; interaction: $F(1,48) = .322$, $P = .573$, $\eta_p^2 = .007$] or the migration test [presentation format: $F(1,48) = .069$, $P = .794$, $\eta_p^2 = .001$; text type: $F(1,48) = 1.329$, $P = .255$, $\eta_p^2 = .027$; interaction: $F(1,48) = .044$, $P = .835$, $\eta_p^2 = .001$].

3.5.3 Emotion

The results of the emotion scores are shown in Table 2. The main effect of text type on valence [$F(1,48) = 4.327$, $P = .043 < .05$, $\eta_p^2 = .083$] and dominance [$F(1,48) = 4.309$, $P = .050$, $\eta_p^2 = .078$] was significant, with anthropomorphic texts eliciting higher levels of positive emotion and self-perceived mastery. And the main effect of presentation format on arousal was significant [$F(1,48) = 4.998$, $P = .030 < .05$, $\eta_p^2 = .094$], with the separation condition eliciting higher emotional intensity.

Table 2. Descriptive statistics for learning accuracy and emotion scores

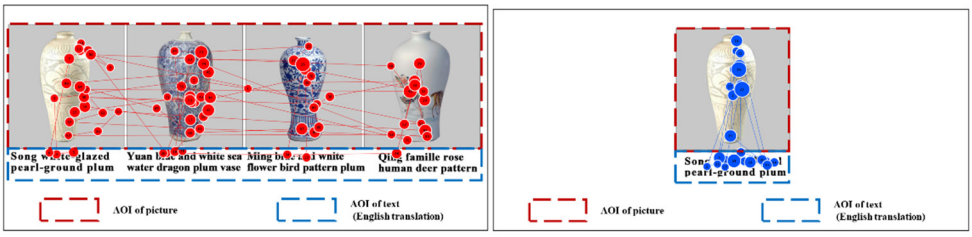
	Inte/Non-anthro M±SD	Sepa/Non-anthro M±SD	Inte/anthro M±SD	Sepa/anthro M±SD
Retention test	.56±.14	.46±.15	.55±.20	.50±.17
Migration test	.49±.15	.47±.15	.53±.18	.53±.19
Valence	6.54±.97	6.38±1.12	6.62±.96	7.54±1.20
Arousal	4.62±1.56	5.62±1.76	5.46±1.05	6.23±1.24
Dominance	5.31±1.70	4.92±1.85	5.92±1.38	6.00±1.00

4 Discussion

This study examined the effects of integrated/separated presentation formats and non-anthropomorphic/anthropomorphic texts on viewers' learning experiences. The specifics of the two conditions are discussed in detail in the following.

For the picture presentation format, it was found that subjects in the integration condition paid less and shorter attention to the pictures without affecting the learning outcome, suggesting that the integration condition may contribute to lower cognitive load and increased learning efficiency. The separation condition, on the other hand, required more attentional focus and mental effort to compare the differences between the artifacts by recalling the previous texts and pictures and thus elicited higher arousal, which was confirmed in the interviews (Subject 11: "I viewed each one independently, at the beginning it was just the text, and after the text

was over the first few might still be a little bit impressionable, and then later on it was not so much"). Meanwhile, there were fewer transitions between pictures and texts in the integration condition, which may be due to the fact that at this point the sight was drawn more to the pictures and switched between them for comparative viewing, again as evidenced by the eye-tracking diagram (see Fig. 4) and the interviews (Subject 13: "Because it was introduced in the previous text, I compared it, for example, the Early Shang Dynasty is the pointy one, and the other ones are kind of cylindrical"). This suggests, to some extent, that the integrated format shows some effectiveness in helping viewers learn the basic knowledge of artifacts efficiently and in facilitating comparisons, in line with scholars who have advocated the use of comparative strategies in museum website displays [4] and the comparative contexts of artworks teaching [28], arguing that comparisons between artifacts will lead to more positive thinking and feeling on the part of viewers, and fulfill an educational function.



(a) Integrated form (subject 39) (b) Separated form (subject 7)

Fig. 4 Examples of eye-tracking diagram

These results differ somewhat from our previous study, in which the results obtained were that the integrated/separated format did not affect the retention and transfer test outcomes but that the overall use time of viewing, the fixation counts, and fixation duration on ceramic names (4 per group) by subjects were lower in the separated format than in the integrated format [29]. This could be caused by a few reasons which bring more possible topics on museum multimedia learning. Firstly, the greater quantity of pictures (8 per group) viewed in this study might have exceeded the viewers' threshold for the individual's reliance on short-term memory for viewing under the separated condition, and material complexity is a crucial boundary condition for the validity of the segmentation principle. Second, there might be an impact based on the type of introductory texts. In the present experiment, an interaction effect between text type and picture presentation format on text fixation was found, in particular, only in the anthropomorphic condition where the integrated form had shorter fixation durations for artifact names than the separated form. Lastly, there were individual variations in subjects' motivations for viewing and comparing, e.g., some viewers did not actively compare artifacts carefully but only viewed them from an appreciative perspective. Given the complexity of museum display methods and audience learning in real-life situations, further research is required to determine the effects of presentation format and other possible factors. But at the very least, this experiment shows that online displays or instruction of artifacts should consider whether to use explanatory text in conjunction with a separated form with a relatively large number of artifacts, as this group had the worst learning outcomes.

For text type, the mean saccade amplitude was longer for anthropomorphic texts, suggesting that this type of text is less difficult to process, and its vivid and novel expressions resulted in

a higher degree of pleasure and control over the viewed content (anthropomorphic - subject 32: "I found it quite interesting, it was really a bit more comprehensible than a paragraph like that in a museum..."; non-anthropomorphic - subject 10: " I think this purely objective description might just require some willpower to read it"). Another intriguing finding was that under the integration condition, subjects in the anthropomorphic text group paid less attention to the names of artifacts than those in the non-anthropomorphic group. This could be because the textual expression made it easier for viewers to grasp the features of the artifacts or improved the efficiency of name learning, whereas the descriptions in the non-anthropomorphic texts were so specialized that they needed to be organized again in combination with the names and pictures. However, this anthropomorphic advantage was offset in the separation condition by the processing difficulties caused by the presentation format. These findings imply that anthropomorphic texts could have some future as a growing form of expression. Li et al. also discovered that anthropomorphic descriptions of artifacts could narrow the psychological distance between visitors and artifacts, which in turn affects the viewers' willingness to learn more, recommend, and revisit [30]. Nevertheless, they also noted that the results may be influenced by social expectations, which is also a limitation of this study. As a result, more research and practice will be necessary to identify the impact of anthropomorphic texts. In addition, proving that anthropomorphic texts have a certain effect does not mean that they will take the place of the current conventional interpretation of cultural artifacts, as there are also variations in the targets to which they are applied, audience preferences, etc. This just provides a viewpoint on how museums draw in more visitors, heighten the audience's emotional experience, and enrich the teaching approaches of cultural artifacts.

There are some theoretical and practical implications to this work. First, it examines and broadens the application context of the multimedia principle. In this experiment, the segmentation principle seems to be less applicable to museum text-picture displays with relatively large-scale collections, possibly because the combined display of cultural artifacts is more contextualized and the audience has the demand to analyze the differences across artifacts in order to understand their characteristics. This again suggests that the application of multimedia design principles in museums needs to focus on how museums vary from formal education and be tested for applicability. On the other hand, the idea of the personalization principle might give artifact exhibitions and teaching a fresh perspective. Secondly, the study's findings would have implications for the field of museum communication. They are expected to contribute to the promotion of cultural communication in a more enjoyable and processable way through interpretive texts of online exhibits, multimedia publicity, etc. Finally, measuring the audience's learning experience from multiple dimensions rather than only concentrating on the cognitive level of gain would provide some references for museum education and the use of cultural artifacts for teaching in schools.

However, there are certain limitations of this study that need to be noted. First, prior knowledge, personal interest, and anthropomorphic tendencies were not measured, and it is worth exploring whether these types of individual characteristics affect the experimental results. Second, whether the results can be generalized to other artifact types, artifact knowledge points, numbers of artifact pictures, viewer types, and other different conditions needs to be further investigated.

5 Conclusions

This study explored the online text-picture display of cultural artifacts based on the principles of multimedia learning. Through experimental research, we initially explore the effects of different presentation formats and text types and find that these factors may have an impact on the audience's learning process and outcomes. This is discussed with a view to providing some ideas for exploring learner-centered design approaches for museum artifact text-picture displays. More comprehensive research that takes more factors into account in the future will provide more guidance on form and content design for museums to improve the quality of their educational services.

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References

[1] Rosli A H, Wahab N A, Alsagoff S N, et al.: Students' preferences of learning materials during unprecedented online learning due to COVID-19. Malaysian Journal of Computer Science. pp. 38-44 (2021)

[2] Orlandi S D, Calandra G, Ferrara V, et al.: Web Strategy in Museums: An Italian Survey Stimulates New Visions. Museum International. Vol. 70, pp. 78-89 (2018)

[3] Schwan S, Dutz S, Dreger F.: Multimedia in the wild: Testing the validity of multimedia learning principles in an art exhibition. Learning and Instruction. Vol. 55, pp. 148-157 (2018)

[4] Ying C, Shan C.: An effective mode of information dissemination and learning—Communication strategy of digital museum. 2014 9th International Conference on Computer Science & Education. IEEE, pp. 807-811 (2014)

[5] Ye L, Su H, Zhao J, et al.: The impact of multimedia effect on art learning: Eye movement evidence from traditional chinese pattern learning. International Journal of Art & Design Education. Vol. 40, pp. 342-358 (2021)

[6] Mayer, R. E.: The Cambridge handbook of multimedia learning. (2nd edition). Cambridge university press, UK (2014)

[7] Mayer R E, Moreno R.: Nine ways to reduce cognitive load in multimedia learning. Educational psychologist. Vol. 38, pp. 43-52 (2003)

[8] Mayer R E, Fennell S, Farmer L, et al.: A personalization effect in multimedia learning: Students learn better when words are in conversational style rather than formal style. Journal of educational psychology. Vol. 96, pp. 389 (2004)

[9] Reichelt M, Kämmerer F, Niegemann H M, et al.: Talk to me personally: Personalization of language style in computer-based learning. Computers in Human behavior. Vol. 35, pp. 199-210 (2014)

[10] Liu Q, Liu M, Yu S, et al.: Design and implementation of virtual museum learning environment from the perspective of multimedia learning theory. 2021 International Symposium on Educational Technology (ISET). IEEE, pp. 266-269 (2021)

[11] Guo D, Wei X, Li Z.: The Effect of Virtual Museum on Students' Cognitive and Non-Cognitive Abilities: From the Perspective of Multimedia Learning Theory. 2019 International Joint Conference on Information, Media and Engineering (IJCIME). IEEE, pp. 378-382(2019)

[12] Novak M, Schwan S.: Does touching real objects affect learning?. Educational Psychology Review. Vol. 33, pp. 637-665 (2021)
[13] Noetel M, Griffith S, Delaney O, et al.: Multimedia design for learning: An overview of reviews with meta-meta-analysis. Review of Educational Research. Vol. 92, pp. 413-454 (2022)
[14] Moreno R.: Does the modality principle hold for different media? A test of the method-affects-learning hypothesis. Journal of Computer Assisted Learning. Vol. 22, pp. 149-158 (2006)
[15] Mayer R E, Estrella G.: Benefits of emotional design in multimedia instruction. Learning and Instruction. Vol. 33, pp. 12-18 (2014)
[16] Wong R M, Adesope O O.: Meta-analysis of emotional designs in multimedia learning: A replication and extension study. Educational Psychology Review. Vol. 33, pp. 357-385 (2021)
[17] Um E, Plass J L, Hayward E O, et al.: Emotional design in multimedia learning. Journal of educational psychology. Vol. 104, pp. 485 (2012)
[18] Stark L, Brünken R, Park B.: Emotional text design in multimedia learning: A mixed-methods study using eye tracking. Computers & Education. Vol. 120, pp. 185-196 (2018)
[19] Hui J, Zheng Y, Li Dan: Effects of graphic anthropomorphic design on college students' multimedia academic performance, emotion, and psychological perception. Journal of Bio-education. Vol. 10, pp. 405-410 (2022)
[20] Letheren K, Martin B A S, Jin H S.: Effects of personification and anthropomorphic tendency on destination attitude and travel intentions. Tourism Management. Vol. 62, pp. 65-75 (2017)
[21] Duchowski A T, Duchowski A T.： Eye tracking methodology: Theory and practice. Springer, Berlin (2017)
[22] Dondi P, Lombardi L, Porta M, et al.: What do luthiers look at? An eye tracking study on the identification of meaningful areas in historical violins. Multimedia Tools and Applications. Vol. 78, pp. 19115-19139 (2019)
[23] Rayner K.: Eye movements in reading and information processing: 20 years of research. Psychological bulletin. Vol. 124, pp. 372 (1998)
[24] Tang P, Yao Z, Luan J, et al.: How information presentation formats influence usage behaviour of course management systems: flow diagram navigation versus menu navigation. Behaviour & Information Technology. Vol. 41, pp. 383-400 (2022)
[25] Alemdag E, Cagiltay K.: A systematic review of eye tracking research on multimedia learning. Computers & Education. Vol125., pp. 413-428 (2018)
[26] Bradley M M, Lang P J.: Measuring emotion: the self-assessment manikin and the semantic differential. Journal of behavior therapy and experimental psychiatry.Vol. 25, pp. 49-59 (1994)
[27] Eberhardt J L, Dasgupta N, Banaszynski T L.: Believing is seeing: The effects of racial labels and implicit beliefs on face perception. Personality and Social Psychology Bulletin. Vol. 29, pp. 360-370 (2003)
[28] Koroscik J S, Short G, Stavropoulos C, et al.: Frameworks for understanding art: The function of comparative art contexts and verbal cues. Studies in Art Education. Vol.33, pp. 154-164(1992)
[29] Zheng X, Jiang Y, Cheng H, et al.: How to Arrange Texts and Pictures for Online Visitors? Comparing Basic Ceramic Display Forms with Eye-Tracking. ACM Journal on Computing and Cultural Heritage. (2024)
[30] Li Y W, Wan L C, Luo X, et al.: If museum treasures could talk: How anthropomorphism increases favorable visitor responses. Annals of Tourism Research. Vol. 99, (2023)