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CAME framework: adapting traditional motifs for educational platforms

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Abstract. Effective educational communication of culturally dense decorative motifs in screen-based educational materials was treated as a continuing design challenge in digital education. This study aimed to establish and validate a design framework that supported the translation of traditional decorative motifs into clear and teachable information-visualisation posters for educational communication. A qualitative, design-oriented methodology was applied through semi-structured expert interviews, grounded-theory coding with Open Coding, Axial Coding, and Selective Coding, comparative poster design, and expert review using timed first exposure and a follow-up group interview. The interview analysis established four design dimensions, namely Consistency & Distinction, Adaptability, Multisensory Integration, and Emotional Engagement, and these dimensions were generalised as traceable design commitments for educational visuals. Two comparable posters were produced for the same motif extracted from illustrations in *"The new diagram of Confucian imagery"*, with one poster guided by the framework and the other developed as an intuition-based baseline. The expert review showed that the framework-guided poster was interpreted as having a clearer hierarchy, easier identification of key educational content under time pressure, and more stable visual coding than the baseline poster. The analysis also showed that the framework improved the explainability of major design decisions by linking these decisions to explicit criteria rather than personal preference. The results were applicable to researchers and practitioners in information visualisation and visual communication who developed educational resources for cultural knowledge dissemination in multimedia educational environments

Keywords: cultural heritage communication design; information visualisation; multimedia education; grounded theory coding; expert review; visual hierarchy; digital education

INTRODUCTION

Traditional decorative motifs, as integral components of traditional visual culture, have long carried regional memory, historical experience, and social beliefs. These patterns not only form unique visual symbols of architecture but also play a role in shaping local cultural identity and spatial memory. However, how to effectively apply these traditional cultural symbols to digital education platforms through modern visual design methods to enhance the communicative effectiveness remains an unresolved issue. The application of traditional cultural elements in digital education platforms has gradually become a hot topic in academic research. Many scholars have focused on the integration of information visualisation design and

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cultural communication, exploring how modern technologies and design principles can make traditional patterns effectively communicate in digital formats.

According to U.B. Qushem *et al*. (2021), traditional patterns and symbols need to be transformed through multimodal design strategies in order to better meet the needs of modern learners. Similarly, K. Tomita (2022) emphasised that when handling cultural symbols, appropriate design methods can significantly improve learners' visual understanding and emotional connection. In parallel, the latest scholarship has begun to treat illustrations and diagrams in historical books as analysable visual corpora rather than as purely archival images. According to X. Mei *et al*. (2025), historical Chinese books contain diverse visualisations and illustrations that can be systematically extracted and organised for analysis, which makes book-based motifs a traceable source for design inquiry. S. Goud *et al*. (2024) similarly noted that visual methods can improve access to ancient manuscripts and books in digital collections, yet design-oriented translation from such motifs into teachable educational visuals remains less discussed. Furthermore, C. Troussas *et al*. (2025) suggested that personalisation elements and voice design in educational settings can increase learner engagement through more humanised interaction modes. However, these studies mostly focused on simplifying information delivery and aesthetic presentation, with limited discussion on how to preserve the depth and symbolic significance of cultural symbols while integrating these symbols effectively into multimedia educational platforms.

W. Nilam (2023) pointed out that while visual embellishments play an important role in enhancing aesthetic appeal, excessive decoration may compromise the clarity and readability of the information. Therefore, K. Baer (2021) advocated that decoration should harmonise with the communicative function of content rather than relying solely on visual appeal. In the specific application of visual design, the signalling principle proposed by R.E. Mayer & L. Fiorella (2022) emphasised guiding learners' attention through effective visual cues to ensure that the learners focus on the most relevant information. This principle is particularly important when dealing with traditional cultural patterns, as these patterns are often rich in layered meanings, requiring clear visual signals for learners to understand the cultural and educational values. Additionally, R. Bañez & H. Mosteyro (2024) evaluated the sufficiency of the multiplicity functions of visual hierarchy, exploring how clear visual design can help learners better understand complex cultural information, and emphasising that such clarity can reduce cognitive load and increase the acceptability of information.

Despite the extensive research focused on the aesthetic and semiotic aspects of visual design, most studies have centred on the decorative function of design elements, with insufficient exploration of how these elements promote learner understanding and engagement in multimedia educational contexts. Specifically, the visualisation and application of traditional motifs in visual communication design have not been systematically analysed in terms of the effects on learner perception and educational communication outcomes. The purpose of this study was to examine how motifs extracted from illustrations in *"The new diagram of Confucian imagery",* a classical illustrated Chinese text, could be translated into visual design forms suitable for short-format educational communication on digital learning platforms.

MATERIALS AND METHODS

This study adopted a qualitative, design-oriented approach to examine how traditional decorative motifs can be translated into clear and teachable visual forms for educational communication. The empirical materials were drawn from motifs extracted from illustrations in "The new diagram of Confucian imagery" (Verbiest, 1674). A qualitative strategy was selected because the study focused on visual reasoning, design decision-making, and meaning construction, rather than numerical measurement or statistical inference. Expert knowledge was therefore necessary to articulate design-relevant requirements from culturally dense motifs and to assess the applicability in educational visuals. The study followed three sequential stages. The first stage used expert interviews and systematic coding to derive a framework of design requirements. The second stage applied the framework to motif extraction and visual translation, producing two comparable poster sets. The third stage used expert review and a follow-up interview session with the same panel of experts to verify whether the framework provided a traceable rationale for key design decisions. This sequence was intended to keep the connection between conceptual claims, design practice, and evaluative evidence explicit.

Semi-structured interviews were conducted to construct the CAME framework, which includes Consistency & Distinction, Adaptability, Multisensory Integration, and Emotional Engagement. Seven experts participated in the study, including five university faculty members specialising in visual communication and design education and two professional designers with more than five years of experience in digital media and educational visual design. Each interview lasted approximately 45 to 60 minutes and was conducted online or in person. Participation was voluntary. Before each interview, participants received a short information sheet describing the purpose of the study, the interview procedure, the use of audio recording, and the intended use of anonymised quotations in academic publication. Informed consent was obtained before recording. All interviews were audio-recorded and transcribed verbatim. The study followed widely accepted ethical principles for research involving human participants, aligned with the principles of the Declaration of Helsinki (World Medical Association,

2013). Participants were informed about being able to decline to answer any question and withdraw at any time without consequences. Personal identifiers were removed during transcription, and quotations used in the manuscript were anonymised. Audio files and transcripts were stored on password-protected devices and were accessible only to the research team.

Interview questions focused on recurrent difficulties in translating traditional motifs into educational visuals, strategies for improving visual clarity and learner engagement, and the role of sensory and affective factors in learning-oriented visual communication. The transcripts were analysed following grounded-theory coding procedures (Hakkak *et al*., 2023) in three steps: open coding, axial coding, and selective coding. Open coding captured recurring concerns and practical design problems expressed by the experts. Axial coding connected these concerns into higher-level categories that clarified the causes and design implications. Selective coding then consolidated the categories into four core dimensions, which collectively form the CAME framework (Table 1).

Table 1. Grounded theory coding table for CAME framework

Open coding	Axial coding	Selective coding
Difficulty in balancing traditional symbols and clarity	Symbol-readability tension	Consistency & Distinction
Need to distinguish decorative and communicative elements	Visual functionality	Consistency & Distinction
Lack of adaptation for younger users	User-centric design	Adaptability
Importance of emotional engagement	Emotional design relevance	Emotional Engagement
Low usability of traditional motifs on digital platforms	Symbol-readability tension	Consistency & Distinction
Confusion caused by overly ornate visual forms	Visual functionality	Consistency & Distinction
Demand for multisensory engagement	Multisensory support	Multisensory Integration
Concern for cognitive overload in visual design	Visual functionality	Multisensory Integration

Source: compiled by the authors

To strengthen methodological transparency, the study used a two-step logic in framework development. First, the four CAME dimensions were derived inductively from the interview data through grounded-theory coding. Second, after the dimensions had been established, each of these dimensions was theoretically aligned with relevant multimedia learning principles proposed in R.E. Mayer & L. Fiorella (2022) and R.E. Mayer (2024) to support framework operationalisation in design practice and expert review. This alignment drew on principles related to visual cueing, information organisation, and processing management (e.g., signalling, coherence, segmenting, and modality). This alignment was used to define observable design criteria and comparative evaluation indicators, rather than to predetermine the coding categories. The visual materials consisted of traditional decorative motifs extracted from illustrations in "The new diagram of Confucian imagery" (Verbiest, 1674), with particular attention to instrument-related images. Motif extraction followed a traceable procedure that included locating relevant illustrations, inspecting enlarged details, identifying candidate motif units, and producing vector versions. Candidate motifs were included when the contours were sufficiently complete, the boundaries were visually stable, and the internal structure was clear enough to support reliable vector extraction. Motifs that appeared fragmented, heavily occluded, or ambiguous in outline were excluded. A corpus of nineteen motifs was established and grouped into three semantic classes: natural elements, symbolic figures and culturally coded creatures, and abstract geometric structures. Motifs were digitised and vectorised using standard graphic design software – Illustrator and Figma. Shape-grammar operations, including rotation, reflection, scaling, and repetition, were applied to explore formal variation while preserving recognisable structural features.

Following motif extraction and vectorisation, the study proceeded to construct the central visual subject of the poster from the selected motif corpus. Before poster design began, the main motif shown in the posters was not taken as a single extracted fragment in isolation. Instead, eight motif samples were first selected from the nineteen-item corpus according to the sample-selection criteria described above, including contour completeness, boundary stability, and suitability for reliable vector extraction. These selected samples were then combined to form a new composite central motif, which became the primary visual subject to be communicated and explained through the poster design. This composite construction made the visualisation task more representative of real educational communication, because it required the design to explain both the symbolic meaning of each motif unit and the structural logic of the re-combination, thereby providing a stricter and more comparable test of whether CAME could offer a traceable rationale for organising complex cultural information.

Based on the CAME framework, two comparable poster sets were produced. Each set contained one information-visualisation poster, and both posters focused on the same motif drawn from *"The new*

diagram of Confucian imagery" (Verbiest, 1674). The design goal was educational communication, that is, to support short-form public-oriented explanation of the motif and its associated cultural meaning through a clear and teachable visual composition. The CAME-guided poster treated the four dimensions as explicit design commitments, whereas the comparison poster was developed without explicit use of the framework and relied on conventional design intuition. For verification, the same group of seven experts reviewed both posters using a qualitative rubric aligned with the four CAME dimensions. Experts rated each poster using a three-level ordinal scale, namely High, Medium, and Low, across the four CAME dimensions and provided short written comments. The choice of a three-level ordinal scale was methodologically appropriate for a timed first-exposure task with a short viewing window and limited scoring burden. Although E.C. Aybek & C. Toraman (2022) reported in Item Response Theory that three-category scales typically provide less measurement information and have a narrower range of discrimination than five- or seven-category formats, the main goal of this study was not detailed psychometric measurement, but rather a quick, comparable, and verifiable expert assessment that could be consistently recorded within one minute after initial review and then explained during subsequent discussion.

Based on the one-minute timed first exposure, experts provided an immediate judgment of (1) educational comprehensibility, (2) clarity of visual hierarchy, and (3) overall aesthetic acceptance. After the timed viewing of both posters, an in-person group interview session was conducted with the same panel and lasted approximately 20–30 minutes. Experts used the same three-level ordinal scale (High/Medium/Low) to evaluate each poster across the four CAME dimensions. Low, Medium, and High ratings were coded as 1, 2, and 3 for reporting (Mean = Σscore/7; SD = sample standard deviation). A High rating indicated that the dimension was clearly achieved under time pressure with a stable and traceable design rationale; a Medium rating indicated that the intent was generally recognisable but required additional effort or showed local inconsistencies; a Low rating indicated that the dimension was not adequately supported and hindered understanding or engagement. For Consistency & Distinction, experts considered the stability of visual codes and the separation of instructional and ornamental layers. For Adaptability, the experts considered screen legibility and audience fit. For Multisensory Integration, the professionals considered layered visual organisation and unit-based readability. For Emotional Engagement, the experts considered cultural resonance, compositional balance, and willingness to continue reading. The group interview was used to elicit explanations for comparative judgments and to clarify how specific visual decisions were interpreted in relation to the four dimensions. DeepL and ChatGPT (GPT-5.2) were used as language-support tools during manuscript preparation, including academic translation, terminology clarification, stylistic editing, and consistency checking. All outputs were reviewed, verified, and revised by the authors. These tools were not used to design the study, collect or analyse data, generate figures or results, or draw conclusions. The authors take full responsibility for the content of this article.

RESULTS AND DISCUSSION

The expert interview analysis yielded four recurring design needs that informed the CAME framework. Across participants, the main difficulty was not the lack of cultural content, but the difficulty of making culturally rich motifs readable and instructive in screen-based learning materials. The coded data repeatedly pointed to tension between symbolic density and legibility, the need to separate decorative detail from communicative structure, the need to adjust style for a specific audience and viewing condition, and the importance of affective connection when learners face unfamiliar knowledge. These themes converged into four dimensions, which were used to summarise and organise the design requirements derived from the interviews. This pattern should not be interpreted as a rejection of ornamentation itself. Rather, the interview evidence pointed to a threshold problem in educational visual communication: decorative richness became beneficial only when it remained subordinate to an instructional reading path. This interpretation is consistent with the visualisation research by M. Alebri *et al*. (2023), which showed that embellishment can enhance engagement and perceived visual quality, but may also hinder comprehension when task-relevant structure and cues are not made sufficiently explicit. In the present study, experts repeatedly treated hierarchical stability as the condition under which cultural detail could function as teachable content rather than visual noise.

Table 2 summarised the four CAME dimensions and identified the relationship with Mayer's multimedia learning principles and the observed design criteria used to translate each dimension into visual solutions. The results showed that consistency and discrimination most closely correspond to the principles of signalling and coherence. Experts emphasised the importance of stable visual codes and clear cues that help determine the hierarchy and relevance of information. Adaptability, in turn, was associated with student relevance and information processing management. This includes personalisation, prior learning, and segmentation, as the same cultural symbols may require different approaches depending on the context and audience. Multisensory Integration, which coordinates channels and timing, was linked to the principles of redundancy and temporal contiguity, as experts noted the need to distribute information across perceptual channels to avoid overload. Emotional Engagement, in turn, corresponds to

generative processing principles such as personalisation, voice, and immersion, as emotional resonance helps maintain attention and promotes better assimilation of complex content.

Table 2. CAME dimensions, links to Mayer's multimedia learning principles, and observable design criteria used in this study

CAME dimension	Link to Mayer's multimedia learning principles	Observable design criteria used in this study
Consistency & Distinction	Signalling; coherence; spatial contiguity.	Stable visual codes (line weight, icon logic, typographic rhythm); explicit hierarchy cues; contrast used to mark learning-relevant elements; separation of instructional layers from ornamental layers.
Adaptability	Personalisation; pre-training; segmenting.	Controlled abstraction for screen legibility; platform-aware scaling and spacing; audience-fit stylistic tuning; simplified contours that preserve culturally recognisable structure; progressive disclosure of complex detail.
Multisensory Integration	Modality; redundancy; temporal contiguity.	Layered segmentation of the visual field into readable units; complementary cueing across visual variables; avoidance of duplicate cues that add noise; interface-ready regions that can support optional narration/interaction.
Emotional Engagement	Personalisation; voice; immersion.	Culturally meaningful metaphors; symmetry and balance to support aesthetic acceptance; affective cues that invite identification with cultural meaning; compositional coherence that sustains attention and curiosity.

Source: compiled by the authors based on R.E. Mayer & L. Fiorella (2022) and R.E. Mayer (2024)

From the nineteen-motif corpus, the motif units used in the composite central motif were selected according to the inclusion criteria. The selection was designed to cover the three semantic classes used in this study – natural elements, symbolic figures and culturally coded motifs, and abstract geometric structures – so that the composite motif retained cultural recognisability while supporting clear hierarchy and teachable visual organisation. Table 3 listed the full set of motif units included in the composite central motif and summarised the semantic roles and symbolic meanings as translation cues during geometric abstraction.

Table 3. Motif units used to construct the composite central motif for the poster comparison with semantic classification and translation cues

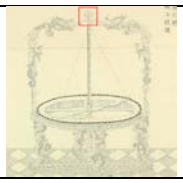
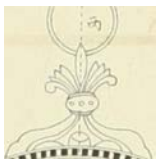
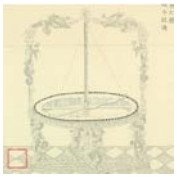
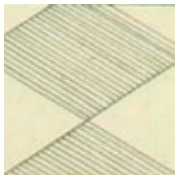
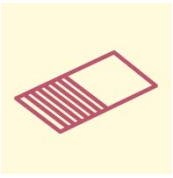
Pattern Name	Ancient book sources	Symbolic figures	Abstract geometric structures	Semantic class (three-category scheme)	Role in composite motif (design logic)	Symbolic meaning
Flame-orb pattern				Symbolic figures / culturally coded symbols	Primary carrier of focal meaning; used to establish a clear instructional focus in the composite motif.	Brightness, auspiciousness, exorcism, vitality, protection.
Treasure-phase flower pattern					Primary carrier of focal meaning; used to support "blessing/prosperity" semantics and visual centrality.	Wealth, prosperity, career, family, abundance.
Ruyi pattern					Secondary symbolic connector; used to link focal units and reinforce cultural recognisability through a conventional motif grammar.	Smoothness, fulfilment, happiness, blessings, auspiciousness.

Table 3. Continued

Pattern Name	Ancient book sources	Symbolic figures	Abstract geometric structures	Semantic class (three-category scheme)	Role in composite motif (design logic)	Symbolic meaning
Scrolling grass pattern				Natural elements	Secondary decorative extension; used to enhance the sense of continuity, vitality, and organic flow of the entire composite motif, while echoing the "prosperity and abundance" semantics of the core pattern.	Continuity, life, abundance, prosperity, vitality.
Key pattern					Structural framing and closure; used to provide a sense of infinite cyclicity, stabilise the visual boundary of the composite motif, and reinforce the theme of "perpetual blessings and continuity".	Infinity, cycles, blessings, wealth, perpetuity.
Ocean wave pattern					Contextual and rhythmic support; used to express continuity/flow and to stabilise reading direction through repeated curvature.	Unification, integrity, peace, stability, era.
Cloud pattern					Contextual and framing support; used to provide visual breathing space and cultural resonance while maintaining motif coherence.	Heritage, blessings, longevity, continuity, harmony.
Stripe pattern				Abstract geometric structures	Structural rhythm and boundary control; used to stabilise composition, improve legibility, and separate layers (instructional vs ornamental).	Structure, order, regularity, clarity, functionality.

Source: compiled by the authors

In the composite construction, symbolic motifs functioned as the primary carriers of explicit cultural meaning, natural-element motifs provided contextual rhythm and continuity, and abstract geometric units stabilised structure and layer separation. This role division kept the visual subject consistent across the two posters while allowing the comparison to focus on whether the CAME-guided design achieved clearer hierarchy, stronger educational readability, and more traceable decision logic under the same educational communication goal. Building on this motif corpus, the study produced two comparable information-visualisation posters (Fig. 1). For Consistency & Distinction, visual stability was maintained through uniform line weight and a consistent structural rhythm, while contrast cues differentiated core instructional layers from decorative detail, reinforcing hierarchy and supporting a legible typographic system (Günay, 2024). For Adaptability, the abstraction level and contour simplification of motif forms were adjusted to improve graphic legibility while preserving culturally recognisable features, so that educational information remained accessible in typical digital viewing conditions. Multisensory Integration was addressed through layered visual organisation and region-based segmentation, supporting stepwise viewing and unit-based reading of the content. Emotional Engagement was strengthened through culturally grounded metaphors, symmetrical composition, and balanced layout, which supported resonance and encouraged

sustained engagement with the cultural theme (Wang & Wang, 2024).

In the expert review, the two posters were treated as a direct comparison because both visualised the same motif from "The new diagram of Confucian imagery" (Verbiest, 1674), while differing only in whether CAME guided the design process. During the one-minute first-exposure viewing, experts rated each poster using a three-level scale (high/medium/low) across the four CAME dimensions and provided short written comments. The distribution of expert ratings for both posters across the four dimensions is summarised in Table 4.

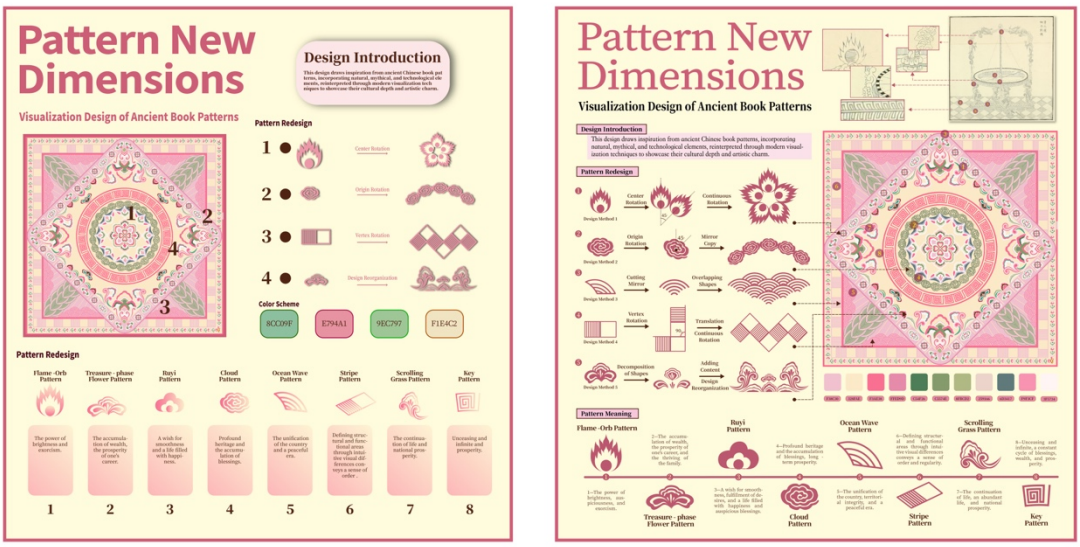


Figure 1. Pattern innovation and visual design outcomes based on the CAME framework

Note: a – a poster without explicit use of the CAME structure, in which the designer's traditional intuition served as the baseline for comparison; b – a poster created with the CAME structure in mind, in which the pattern elements were reorganised into a stable visual language system.

Source: compiled by the authors

Table 4. Distribution of expert ratings and summary statistics for two posters (n=7)

CAME dimension	Poster	Low (1)	Medium (2)	High (3)	Mean	SD
Consistency & Distinction	a	5	2	0	1.29	0.49
	b	0	4	3	2.43	0.53
Adaptability	a	5	2	0	1.29	0.49
	b	1	2	4	2.43	0.79
Multisensory Integration	a	5	2	0	1.29	0.49
	b	2	3	2	2.00	0.82
Emotional Engagement	a	7	0	0	1.00	0.00
	b	0	3	4	2.57	0.53

Source: compiled by the authors

As shown in Table 4, Poster b received higher ratings than Poster a across all four dimensions. The clearest separation appeared in Emotional Engagement, where Poster a was rated Low by all experts (Mean = 1.00, SD = 0.00), whereas Poster b concentrated in Medium to High ratings (Mean = 2.57, SD = 0.53). Poster b also showed higher mean scores in Consistency & Distinction and Adaptability (both Means = 2.43) compared with Poster a (both Means = 1.29). For Multisensory Integration, Poster b showed a moderate improvement (Mean = 2.00) relative to Poster a (Mean = 1.29), with a wider spread of ratings, indicating greater variation in expert judgments on this dimension. Across these ratings and comments, the CAME-guided poster was more often judged as having a clearer hierarchy and more stable visual coding, which helped experts identify the intended learning content within the limited viewing time. By contrast, the comparison poster was more frequently described as mixing ornamental density with instructional structure, which made the reading path less predictable and increased the effort required to infer relationships among elements. The difference observed in the timed first-exposure review can also be interpreted in light of signalling research in multimedia learning. In a meta-analysis, M. Noetel *et al.* (2022) showed that signalling helps learners identify relevant information and organise incoming material more effectively by making structural cues more visible during early processing. Although the present study did not test learning

outcomes statistically, the experts' faster recognition of instructional focus in the CAME-guided poster is consistent with this mechanism and supports the methodological value of including a timed first-exposure task in the comparative review.

In the subsequent 20-30 minute in-person group discussion with the same panel, experts explained the reasons behind the ratings in ways that aligned with the rubric. Comments associated with Consistency & Distinction highlighted the separation of learning-relevant layers from ornamental layers and the use of explicit hierarchy cues. Adaptability was discussed in relation to controlled abstraction and simplification that improved screen readability while preserving recognisable motif structure. Remarks linked to Multisensory Integration focused on layered segmentation that supported stepwise inspection and made the composition ready for optional multimodal extension without forcing additional channels. Emotional Engagement was described through compositional balance and culturally meaningful metaphors that increased acceptance and curiosity. The findings indicated that the CAME framework provides a practical bridge between the translation of traditional motifs and multimedia learning design. Its key value lies in transforming recurring expert concerns into a set of clear design commitments that are maintained throughout the design process. This is especially relevant for screen-based learning, where the challenge often lies not in the lack of information, but in how to guide learners' attention and preserve meaning without increasing unnecessary cognitive load.

The **Consistency & Distinction** principle aligns well with established signalling theory. According to R.E. Mayer & L. Fiorella (2022), signalling supports learning by making structure and relevance visible, which helps learners allocate attention more efficiently. G. Wang *et al.* (2024) further showed, through a meta-analysis, that signalling tends to improve learning outcomes and often reduces perceived cognitive load. This logic is reflected in this study. Experts did not call for richer ornamentation but emphasised stable visual codes and clearer hierarchy. When hierarchy cues were explicit and visual codes were consistent, the reading path became more predictable, and the instructional intent was easier to extract from the image.

Adaptability in educational visuals is more than just a stylistic decision. A. Ruf *et al.* (2022) argued that interface aesthetics can enhance situational interest and help sustain engagement, which indirectly supports learning activity. This study supported the view of Adaptability as part of instructional clarity, rather than an optional refinement. In the poster designs, adaptation was not pursued for novelty but aimed to reduce avoidable visual complexity while maintaining culturally recognisable structure. This ensured that traditional motifs remained meaningful and legible across different viewing conditions. M. Alebri *et al.* (2023) pointed out that viewers' perceptions of decorative visual elements depend on whether the decoration supports reading and interpretation, rather than on ornamentation alone.

Multisensory Integration in this study was not fully implemented through an interactive system but was instead based more on the dual-channel definition of combining text and images, adapting to the needs of multimedia education. R.E. Mayer (2024) explained that organising information effectively and hierarchically can help learners process study experience more efficiently. Multilayered visual structures were used to divide information into independent regions, allowing students to learn content step by step. This design is consistent with dual-channel theory, which suggests that cooperation between visual and auditory channels improves learning. In this study, visual segmentation and structured image processing can help students identify key information more quickly and gradually assimilate more details.

T. Doyle (2023) pointed out that learning benefits when information is organised into manageable units, because this helps learners handle essential processing demands. For example, the layered structure could be extended in a platform setting by mapping regions to optional explanatory prompts or brief narration, which would allow additional context to be accessed without changing the core visual organization, thereby further increasing the immersive learning experience. As E. Dritsas *et al*. (2025) suggested, multimodal design should be carefully coordinated to avoid unnecessary redundancy and instead enhance understanding through precise sensory integration. The design in this study offers a foundational framework for future interactive platforms, where layered visual information and potential interactive modules can effectively enhance learners' understanding and retention of complex information.

Emotional Engagement aligns with growing evidence in emotional design within multimedia learning. In a systematic review, D. Mutlu-Bayraktar (2024) reported that emotional design can foster learner engagement, although its effects can vary depending on the context and implementation. Y. Wang *et al*. (2021) also showed that emotional design can influence learning-related responses in culturally grounded materials. This aligns with the expert feedback in this study. Experts described emotionally resonant compositions as a means to invite identification with cultural meaning, which is crucial for maintaining learners' attention, especially when content is unfamiliar. The emotional advantage reported by experts should be understood as a learning-relevant design condition rather than as a purely aesthetic effect. Research on emotional design in multimedia learning by Y. Le *et al*. (2021) has shown that formal design variables, including shape and colour, can influence affective state and cognitive engagement during learning tasks. In this study, the

experts' comments suggested a comparable pattern: when compositional balance and culturally meaningful metaphor were more coherent, viewers expressed stronger willingness to continue reading, which in turn supported sustained attention to the educational message.

Overall, the results of this study confirmed that applying Mayer's multimedia learning principles through the CAME structure effectively optimises student attention and reduces cognitive load. Incorporating signalling, adaptability, Multisensory Integration, and Emotional Engagement into the design of learning materials enhances the perception and understanding of information, especially in the context of culturally meaningful motifs. Expert feedback indicated that these principles not only support learning but also create a clear and consistent structure that promotes deeper retention of material. The results also highlighted the importance of multimodal approaches in creating learning platforms that can increase student engagement and improve knowledge retention.

CONCLUSIONS

This study revealed that the CAME framework, which includes the principles of Consistency & Distinction, Adaptability, Multisensory Integration, and Emotional Engagement, can effectively translate traditional decorative motifs into educational visuals. The analysis showed that when applying the CAME framework, the resulting posters were clearer in visual hierarchy and more stable in the design, which made it easier for learners to identify key educational content. The comparison set, created without explicit guidance from the framework, struggled to separate decorative elements from instructional layers, which led to a less predictable reading path and increased cognitive effort to understand the visual relationships. It was found that the Consistency & Distinction principle aligned with the signalling theory, as it helped highlight the most relevant information and guide learner attention efficiently. The Adaptability principle allowed the design to be adjusted to meet the needs of different audiences and viewing contexts, ensuring readability on both desktop and mobile platforms. Multisensory Integration was implemented through visual segmentation, which improved the organisation of information and laid the groundwork for potential multimodal enhancements in future iterations. Emotional Engagement was emphasised through the use of cultural metaphors and symmetrical compositions, which contributed to learner engagement by creating a meaningful emotional connection with the content. In future studies, this structure can be confirmed by data obtained from students while performing educational tasks on the platform, so that understanding, attention models, and memorisation can be verified not only on the basis of expert interpretation. It would also be appropriate to test this structure with additional motifs and illustrated sources to verify whether the four dimensions remain stable across different visual grammars and cultural contexts. It is proposed to explore additional multimedia extensions, such as short stories or simple motion cues, as controlled additions to the same visual structure to enhance educational clarity without adding unnecessary complexity.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Фреймворк CAME: адаптація традиційних мотивів для освітніх платформ

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Анотація. Ефективна освітня комунікація культурно-насичених декоративних мотивів у екранних навчальних матеріалах розглядається як актуальний виклик для сучасного дизайну в цифровій освіті. Метою цього дослідження була розробка та валідація дизайнерського фреймворку, який забезпечує трансформацію традиційних декоративних мотивів у чіткі та придатні для навчання постери з візуалізації інформації для освітньої комунікації. У роботі застосовано якісну, орієнтовану на дизайн методологію, що включала напівструктуровані інтерв'ю з експертами, кодування за принципами обґрунтованої теорії (відкрите, осьове та селективне кодування), порівняльне проєктування постерів, а також експертну оцінку за методом першого короткочасного перегляду та подальше групове інтерв'ю. Результати аналізу інтерв'ю дозволили визначити чотири виміри дизайну: «Узгодженість і розрізнення», «Адаптивність», «Мультисенсорна інтеграція» та «Емоційне залучення». Ці виміри були узагальнені як простежувані дизайнерські зобов'язання для створення освітнього візуального контенту. У межах дослідження було створено два порівняльні постери для одного мотиву, взятого з ілюстрацій до «Нової діаграми конфуціанських образів»: один розроблявся на основі запропонованого фреймворку, а інший – як контрольний зразок на основі інтуїтивного підходу. Експертна перевірка показала, що постер, створений за фреймворком, характеризувався чіткішою ієрархією, легшим розпізнаванням ключового навчального контенту в умовах обмеженого часу та стабільнішим візуальним кодуванням порівняно з контрольним зразком. Аналіз також продемонстрував, що фреймворк підвищує рівень обґрунтованості основних дизайнерських рішень, пов'язуючи їх із чіткими критеріями, а не з особистими вподобаннями автора. Практична цінність роботи полягала у можливості застосування результатів дослідниками та практиками у сферах візуалізації інформації та візуальної комунікації, які займаються розробкою освітніх ресурсів для поширення культурних знань у мультимедійних навчальних середовищах

Ключові слова: дизайн комунікації культурної спадщини; візуалізація інформації; мультимедійна освіта; кодування за обґрунтованою теорією; експертна оцінка; візуальна ієрархія; цифрова освіта