

Effective Human-AI Interaction as Observational Learning for Multisensory Creative Fashion Design: Sound(music)-Text-Image Processing

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Abstract The rapid advancement of artificial intelligence (AI) increasingly challenges the traditional view of creativity as a uniquely human domain, raising concerns about the erosion of human creative capacities. This study investigates whether incorporating auditory stimuli into visually-driven design activities can enhance creativity, and further explores how multisensory training involving images, language, and music (modern classical) can support human-AI collaboration. An exploratory three-month study was conducted with 23 third-year fashion design students, who engaged with the modern classical piece Cello Sonata No. 1 ‘Gyeongya’ while utilising Generative AI tools (Midjourney, DALL-E 3, and Bing Image Creator) throughout the concept development and design stages. Participants were guided to use linguistic thinking activities to bridge auditory and visual perceptions. The findings demonstrate that multisensory stimulation, particularly when coupled with structured linguistic reflection, facilitated cognitive expansion and enabled the generation of a wider range of visual imagery. These outcomes validate the potential of human-AI interaction in enhancing synergistic creativity by integrating auditory and visual elements. This study contributes to the emerging field of interdisciplinary creative education, offering new insights into how AI technologies and multisensory approaches can be strategically applied to strengthen creative thinking in fashion design pedagogy.

Keywords Artificial intelligence (AI), Generative AI, Fashion design pedagogy, Multisensory creativity

Citation Lee, Y. K. (2025). Effective human-AI interaction as observational learning for multisensory creative fashion design: sound(music)-text-image processing. *International Journal of Costume and Fashion*, 25(2), 89-100.

Introduction

The rapid advancement of digital technologies such as robotics, artificial intelligence (AI), and the Internet of Things (IoT) has ushered in the era of Industry 5.0, where humans are at the center of technology, fundamentally transforming the way people live and work (Adel, 2022). This new paradigm is being shaped by digital technologies, and particularly with the widespread adoption of AI, it is driving a fundamental reevaluation of the role of humans in automated environments. One of the most recent innovations is generative AI, such as ChatGPT, which was launched in

2022. This AI-based conversational chatbot uses large language models (LLMs) to generate prompts in various languages and derive diverse information and images (Pan et al. 2023). The spread of such AI technology has brought profound changes to various fields, including the fashion industry. AI-fashion fusion is being utilized in various forms, such as AI-generated profiles, AI wardrobes, AI styling, and AI fashion shows. In particular, the popularisation of AI demonstrates that services

Received June 17, 2025; Revised August 4, 2025; Accepted August 12, 2025

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea(NRF-2024S1A5A8021365)

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leveraging close interaction between humans and AI are becoming deeply rooted in everyday life.

In the early 2000s, when AI was first introduced, its rapid spread was perceived as a direct challenge to creativity, which had traditionally been regarded as a domain exclusive to humans, leading to widespread anxiety about the potential threat to human creativity (Lee, 2022). However, with the popularisation of generative AI, the symbiotic relationship between AI and humans is evolving from a choice to an inevitable reality. As such, it is now a critical juncture to explore solutions for how humans and AI can collaborate and adapt to an AI-driven society. Therefore, diverse research and analytical perspectives are increasingly needed to investigate methods through which humans and AI can combine their respective strengths to foster a more ideal and collaborative future.

The objectives of this study are as follows. First, we explore whether creativity can be enhanced by introducing auditory elements into design activities, which have traditionally relied on visual stimuli. Second, we aim to verify whether training that promotes multisensory perception by stimulating images, language, and sound (contemporary classical music) can be effectively utilized in human-AI interaction. Finally, through exploratory research based on practical design activities using generative AI, this study investigates the process by which meaning is assigned to images and how concepts are concretized and abstracted through visual development. Through this, the study aims to provide new insights into the evolving relationship between human creativity and AI technology.

Theoretical Background

Observational learning and Effective human-AI interactions

Bandura's (2001) social cognitive learning theory explains how individuals acquire knowledge through observing others, emphasizing the roles of attention, retention, reproduction, and motivation. In design education, especially when integrated with generative AI, this theory provides a valuable lens for understanding how learners engage cognitively and

creatively with external stimuli. Attention is the first and most essential step in the learning process, as one must selectively focus on the model's behaviour to initiate learning. In human-AI interaction, attention is shaped by how intuitively and engagingly the AI system presents stimuli—whether visual, verbal, or auditory. The novelty of AI-generated images or the emotional resonance of auditory stimuli such as music can play a pivotal role in maintaining learners' focus (Bandura, 2001).

The second component, retention, involves encoding and mentally storing the observed information for later retrieval. This cognitive process becomes more robust when multiple senses are involved. For instance, when students are exposed to music and then observe AI-generated visual interpretations of that music, they are prompted to mentally rehearse and restructure the experience into conceptual ideas. Such multisensory encoding facilitates deeper creative thinking (Mayer, 2005).

Reproduction, the third stage, refers to the learner's ability to translate internalised information into tangible outcomes. In design education, this means developing and expressing new visual concepts based on what was observed and processed. The interaction with AI assists in this process by offering visual or textual responses that can be iteratively transformed and refined by the learner, bridging the gap between observation and expression.

Finally, motivation determines whether the learner will actually engage in the observed behaviour. In a creative setting, motivation may stem from internal drives (e.g., self-expression), external reinforcement (e.g., feedback from AI), or emotional stimuli (e.g., music). Bandura (2001) emphasized that learning and performance are separate processes, and that without motivation, even well-retained knowledge may never manifest in action.

Understanding observational learning is crucial for designing meaningful human-AI experiences in creative education. Generative AI, when used as both model and facilitator, can support imaginative exploration and expand the ways students perceive, process, and perform creativity in the AI era. Thus, recent perspectives emphasize that observational learning is not passive but involves active interpretation and synthesis (Greenberg & Safran, 1980; Muzzio et

al., 2009). Within this framework, AI can serve as a co-creative model, prompting learners to observe, reinterpret, and generate new ideas through multisensory interaction.

Multisensory stimulation for creative thinking

Enhancing creativity often requires engaging multiple sensory modalities simultaneously. Multisensory stimulation—particularly the combination of auditory (e.g., music) and visual (e.g., design imagery) cues—has been shown to foster broader associative thinking and support the development of more original ideas (Shams & Seitz, 2008; Lee, 2024). The human brain naturally integrates sensory inputs across modalities, which strengthens cognitive flexibility and promotes deeper, more emotionally resonant creative engagement.

Music, as a temporal and affective stimulus, plays a unique role in this process. It structures time through rhythm and harmony, evokes immediate emotional responses, and stimulates memory and imagination (Roskies, 1995). When auditory stimuli are combined with visual elements—particularly through generative AI tools—learners are prompted to reinterpret emotional and abstract impressions into spatial forms, expanding their conceptual thinking (see Fig. 1).

This multisensory convergence introduces new dimensions into design education. It encourages learners to move beyond

conventional visual thinking patterns and engage in divergent idea generation. However, the complexity of linking auditory impressions to visual outcomes can present cognitive challenges, especially for students unfamiliar with music interpretation or abstract reasoning. Inconsistencies in AI-generated content may also lead to confusion or misalignment with the learner’s intentions.

Nonetheless, multisensory learning environments—when thoughtfully designed—can deepen students’ conceptual exploration and emotional involvement. By training learners to interpret sound, image, and language in an integrated manner, educators can support the development of flexible, reflective, and innovative design approaches. In the context of Industry 5.0, such multisensory-AI collaborations offer promising strategies for cultivating creativity in the next generation of designers.

Methodology

Participants and periods

A total of 23 upper-level fashion design majors participated in the study (4 males and 19 females; M age = 23 years). All participants had completed at least two years of practical

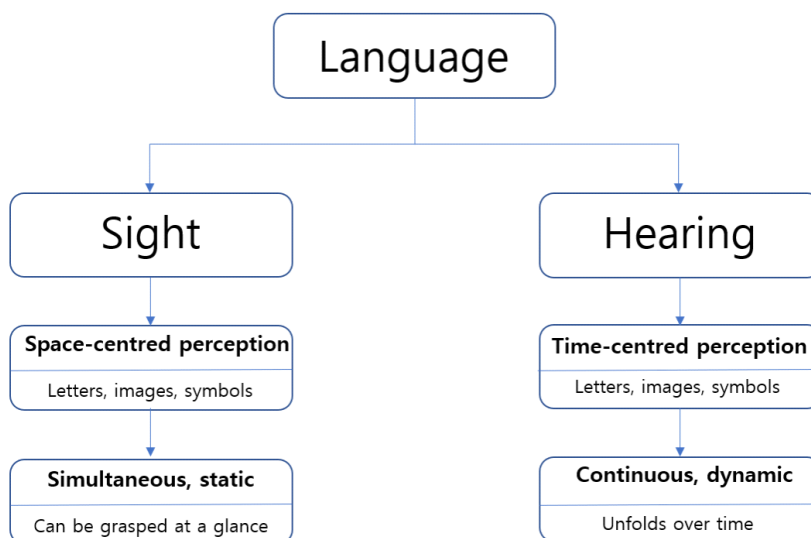


Fig. 1. Concepts of time and space in language, vision, and hearing

design coursework prior to the study. The experimental period spanned three months, from March to June 2024. During this time, participants attended weekly four-hour sessions across seven weeks in total. During the study period, each student listened individually to Cello Sonata No. 1 ‘Gyeongya’ at least 10 times. In addition, the students collectively listened to the piece five times during in-class sessions as part of the design development process. Notably, after the initial music listening phase, a lecture was conducted by the composer, Kim Seung-yeon, to deepen students' understanding of the composition’s emotional and philosophical themes.

Auditory Stimulus

The selected auditory stimulus, Cello Sonata No. 1 ‘Gyeongya’ by Kim Seung-yeon, is a contemporary classical work that explores existential and humanistic themes related to the boundary between life and death. Inspired by the Korean wake ritual (Gyeongya), the sonata’s non-linear structure and emotional complexity offered a rich multisensory stimulus to provoke imaginative design responses. The composition is available at: <https://youtu.be/K2xMJA9MNaQ>.

Research Design

This exploratory study employed a multisensory design framework that integrates auditory (music), verbal (text-based prompts via AI), and visual (AI-generated imagery) elements to enhance creative thinking. The design process in Figure 2 unfolded in four stages adapted from established design methodologies (LaBat & Sokolowski, 1999; Lee &

DeLong, 2016):

- 1) Problem Acceptance – Music listening followed by a lecture with the composer to explore the conceptual and emotional dimensions of the piece
- 2) Idea Inspiration – Emotional and conceptual verbalisation using ChatGPT
- 3) Idea Expansion – Image generation with Midjourney v5.2, DALL·E 3, Microsoft Copilot powered by GPT-4 Turbo, and Bing Image Creator powered by DALL·E 3.
- 4) Design Development – Fashion design output based on interpreted imagery and verbal themes

The composer’s lecture, conducted in the early phase, played a key role in shaping students’ perception of the music and guiding their emotional interpretation, which informed both the verbal and visual stages of the creative process. To evaluate the effectiveness of this multisensory design process, in-depth interviews were conducted with five experts holding doctoral-level qualifications in fashion design. These interviews assessed the utility and impact of AI tools throughout the design development stages.

Multisensory-AI Design Framework

This multisensory-AI design process is illustrated in Figure 3. Students first analysed the music’s emotional content, then verbalised their impressions through descriptive keywords and sentences. These textual interpretations were used to generate images via AI, serving as visual prompts for design development. This iterative cycle—translating sound into

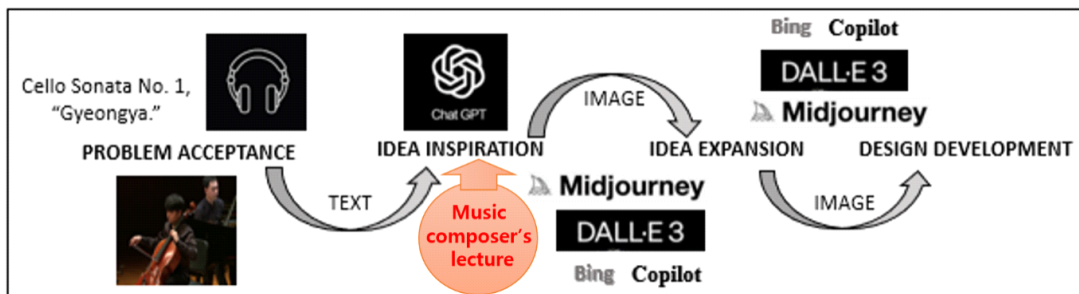
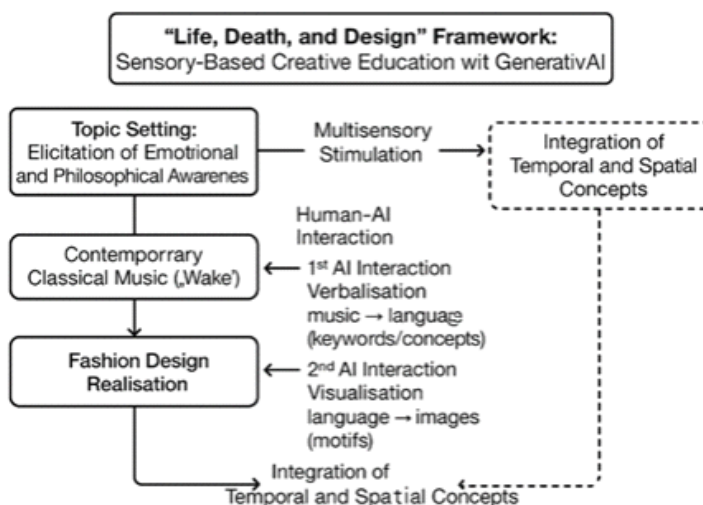


Fig. 2. design process with Generative AI



AI Fig 3. Multisensory-based fashion design framework using Generative AI

text, then into image, and finally into fashion—enabled students to form abstract-to-concrete connections. The temporal structure of the music was embedded into the spatial development of their designs, allowing narrative flow and conceptual layering to emerge. Through this integrative method, students were able to externalize complex emotional responses, refine conceptual depth, and extend their design vocabulary. The composer’s lecture functioned as a critical pedagogical anchor, enabling learners to access the emotional and symbolic dimensions of the music and creatively reinterpret them through human-AI collaboration.

Result and Discussion

problem acceptance (Music and ChatGPT: Text to Text prompt)

We attempted to create visual designs by utilising language-based AI (open AI based on generative AI) as stimuli that simultaneously stimulate space and time. In the first problem acceptance stage, students were first encouraged to listen to Gyeongya without any general explanation of the song. They were asked to experience the process of converting abstract thoughts expanded from modern classical music (Gyeongya) into language and connecting them with images. We began

exploring ‘Gyeongya’ with the main themes of music, fashion, and design.

In the problem acceptance stage, once curiosity about the song (Gyeongya) had been sufficiently stimulated, we moved on to the idea inspiration stage by listening to a lecture by the composer of Gyeongya, which helped us gain a concrete understanding of the background of the song’s creation and its overall narrative. Through this process, the students’ works guided them to explore songs more deeply by understanding the delicate parts of the melody that matched their emotions. While listening to the songs and hearing in-depth analyses of the composer’s songs, the students tended to expand beyond the literal meaning of the word “Wake (Gyeongya)” (enlightenment before a funeral) to philosophical and abstract thoughts about life, death, and new life. This result led to a broader scope of thinking in the subsequent idea inspiration stage, where students utilized ChatGPT to concretize their concepts. The presentation of the research results is illustrated in Figure 4.

idea inspiration: Define Concept (ChatGPT: Text to Text prompt)

In the idea inspiration stage, ChatGPT can be used to write text prompts for exploring a topic. This stage involves expanding thoughts on the problem identified in the problem

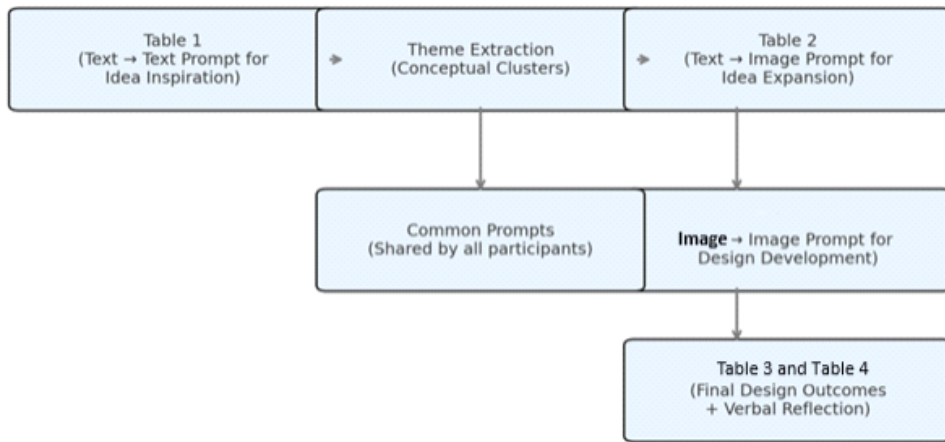


Fig. 4. Process of the result description

acceptance stage to derive specific concepts. For example, students can listen to music and associate the mood, emotions, or feelings evoked by the music to expand their knowledge. Therefore, students can use ChatGPT to obtain explanations for unfamiliar or incompletely understood terms and connect these explanations to their own ideas to generate new ideas. The actual content worked on by students in this stage can be viewed in the table 1.

As seen in Table 1, the prompts written by the students reveal that they raised questions about the meaning of “Gyeongya,” the theme of the music, and the questions about life and death evoked by “Gyeongya,” and connected the

ideas obtained from ‘Gyeongya’ to the philosophy of dice to form questions. Since the students had already deeply understood the background of the music through the composer’s lecture, there were few examples of prompts written to confirm the literal meaning of “Gyeongya,” which signifies waking up before a funeral. Additionally, they explored how abstract thinking could be connected to clothing through questions like “mourning expressed through death and clothing,” demonstrating the process of such exploration. The students showed efforts to interpret abstract thinking in their own way by linking the atmosphere they felt in the music to the title of “Gyeongya.”

Table 1. text to text prompt for idea inspiration

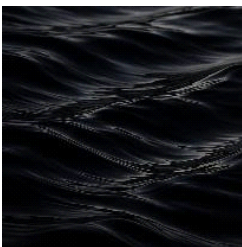
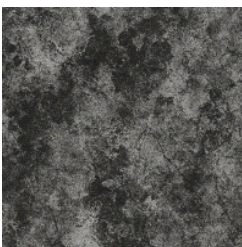
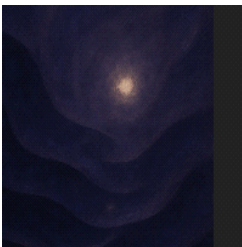

Prompt	Result (ChatGPT)	Keyword/Key concept
S0) Do you think seeing a show or listening to music is something that shapes your identity?	Experiencing live shows and music shapes identity through emotional, cultural, and personal associations.	Identity, Music, Experience, Emotion
S0) What traditional values does Kim’s Cello Sonata No. 1 ‘Gyeongya’ break?	Kim’s Sonata challenges traditional musical form, emotional expression, subject matter (death and dedication), and audience expectations.	Non-traditional form, Death, Emotional depth, Audience discomfort
S3) What is the philosophy of dice?	Themes include existentialism, probability, determinism vs free will, and perception.	Existentialism, Randomness, Perception
S4) Express death and tribute through clothing.	Ideas include black attire, veils, funeral suits, cultural symbols, and white attire in some cultures.	Mourning attire, Symbolism, Cultural dress, Tribute
S9) Give an idea combining ‘Flux Momentum’ and ‘Silhouette in divergence and convergence’.	A collection that visualizes shifting silhouettes capturing flux, divergence, and convergence in motion.	Movement, Transition, Silhouette, Fluidity

idea expansion (Midjourney, DALL·E 3, Bing, Copilot: Text to Image)

In the idea expansion stage, information collected from idea inspiration is connected to specific concepts to expand ideas

in depth. This stage is the process of converting knowledge collected from idea inspiration into concrete images or text. In the idea inspiration stage, students experience the differences between the text prompts they entered and the images generated by generative AI, and in the idea expansion

Table 2. text to image prompt for idea expansion

Related Concept (from Table 1)	Prompt	Result (Image Description/ Image)	AI Tool Used
Fluidity, Emotional passage (S0)	Make a picture of black dark water which is flowing, not in the forest; emphasize the flowing texture	 <p>Abstract black waves with reflective surfaces</p>	Copilot
Randomness, Disruption (S3)	Could you provide me with irregular background image?	 <p>Fragmented, unpredictable textures</p>	Bing
Death, Tribute (S4)	Show me your journey through death and dedication	 <p>Dark, flowing forms representing transition and tribute</p>	DALL·E 3
Funeral motif, Cultural tribute (S4)	Could you provide some ideas on how to express the look of Gyeongya keeping watch over the dead?	 <p>Shadowy figures with veils and muted tones</p>	Bing

stage, they go through the process of writing more specific text prompts and generating various images. Additionally, by repeatedly experiencing images that are more developed than expected or completely unexpected, users refine their concepts.

The students who participated in the study explained that in the idea expansion stage, they were able to derive images that served as the basis for forming image maps from text and explore their thoughts more deeply depending on the topic. The students experienced expanding the various keywords derived in the idea inspiration stage into images in the idea expansion stage and generating more advanced images from the images. This prepared them to enter the next stage, the design development stage, and begin costume design in earnest. As shown in Table 2, the participants approached the meaning contained in ‘Gyeongya’ as the somewhat abstract concepts of life and death and explored images that could be realised through them. The students did not approach ‘Gyeongya’ from the structural form of clothing from the beginning, but rather utilised generative AI to derive images that could convey the atmosphere and concepts evoked by ‘Gyeongya.’ As seen in Table 2, the final results include images that capture the atmosphere of ‘Gyeongya,’ the mood associated with death, and the abstract feelings (such as uncomfortable and irregular) that the students derived from ‘Gyeongya.’

design development (Midjourney, DALL·E 3, Bing, Copilot: Image to Image)

The results obtained through Generative AI in the design development stage were somewhat limited for use as design deliverables, and the design quality of the results also revealed limitations. Most of the derived designs were robe-style dresses, and the generated images mainly conveyed a dark atmosphere. These results remained at a level suitable only as reference materials for subsequent design development. In the subsequent design development stage, individual students were required to integrate the mood images derived from the idea expansion stage and the ideas derived from text prompts in a more cohesive manner, and develop them into more advanced design works based on their own experiences.

Currently, the results of the fashion design image process, which utilises generative AI tools to design text

prompts and garment compositions independently without inputting image data, remain at a somewhat disappointing level. During the fashion design development process, students expanded their thinking through multisensory thinking by utilising music (auditory), text (language), and images (visual), and it was observed that they effectively utilised linguistic thinking activities in the gap between auditory and visual to generate more diverse images. This demonstrates that incorporating human-AI interaction into the thinking process by leveraging the intersection of visual (design) and auditory (music) elements can enhance synergistic creativity, thereby proving its potential for developing interdisciplinary creative fashion design.

As seen in the final results in Table 3, the students interpreted life and death as objects that define their own lives, and this was not entirely dark. They expressed the somewhat heavy and philosophical themes of life and death through exaggerated forms and complex combinations, creating a labyrinth (S2 in Table 3). Additionally, they symbolised the process of life and death using dice (S3 in Table 4).

More specifically, participant S2 began the design process by verbalising impressions of the music Gyeongya through ChatGPT using prompts such as “What does a labyrinth of emotion at the boundary of life and death look like?” The AI-generated textual responses provided abstract concepts such as entrapment, search, convergence, and infinite passage, which were then used as keywords in DALL·E 3 and Midjourney to generate initial visual motifs. These images depicted twisted corridors, spiral structures, and reflective surfaces, which S2 interpreted as metaphors for emotional complexity and transition. The final design incorporated layered fabrics, asymmetrical draping, and a volumetric silhouette to reflect the psychological entanglement between life and death, influenced by both the music’s structure and the AI’s visual translations.

Participant S3, on the other hand, approached the theme from the perspective of chance and the unknowable nature of mortality. Using prompts like “What is the philosophy of dice?” and “Express randomness and quiet acceptance through fashion,” S3 used ChatGPT to derive themes such as existentialism, free will, probability, and finality. These

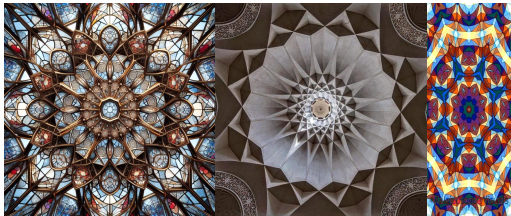


concepts were translated into visual references using Bing Image Creator and Midjourney, which yielded abstract patterns resembling dice faces, fragmented forms, and textured surfaces. S3 selected visual outputs that showed sharp contrasts and geometric repetition, and incorporated these into the costume design through modular elements, bold contrast in fabrics, and symbolic detailing on accessories. The result was a garment that visualised the unpredictability of life events while evoking a quiet, ritualistic elegance.

Students explained that generative AI tools were instrumental in helping them concretize abstract concepts and establish visual direction through text-based prompts and image generation. While the outputs were seen as useful references for idea development and mood generation, many

noted that the results lacked technical precision and diversity in garment structure. As such, students suggested that interactive design processes—where their own sketches or visual ideas could be used as AI input—would likely yield more satisfying outcomes.

To assess the validity and applicability of these results, in-depth interviews were conducted with five experts holding doctoral-level qualifications in fashion design. The experts generally agreed that the integration of auditory, linguistic, and visual stimuli provided a unique and cognitively rich foundation for creative ideation. They emphasized that AI-generated imagery served as a meaningful conceptual tool, especially in early ideation stages. However, they also highlighted limitations in silhouette diversity and structural

Table 3. KALEIDPSCOPE of Student (S2) final design process

Design Stage (AI Tool Used)	Prompt / Theme	Key Idea	Visual Output
Problem Acceptance (ChatGPT)	Listening to 'Gyeongya' (Cello Sonata No. 1) and lecture by composer	Reflections on life and death as an emotional boundary	
Idea Inspiration (ChatGPT Midjourney)	Make an image of stained glass in a kaleidoscope	Fragmented light, layered perception	 <p>KALEIDPSCOPE A PHILOSOPHER'S TOOL</p> <p>THEME 1 - OVERLAP</p> <p>PHILOSOPHERS USE KALEIDPSCOPIES AS TOOLS TO LOOK AT THE WORLD.</p> <p>THE THINGS WE'RE LOOKING AT ARE OVERLAPPING LIKE KALEIDPSCOPIES.</p>
Idea Expansion (DALL·E 3)	Overlapping realities change the world	Abstract kaleidoscope pattern representing shifting identity	 <p>KALEIDPSCOPE A PHILOSOPHER'S TOOL</p> <p>THEME 2 - DISMANTLE</p> <p>CAN LOOK THROUGH THE KALEIDPSCOPE AT THE CONNECTION BETWEEN KNOWING REALITY AND BEING A PHILOSOPHER</p>




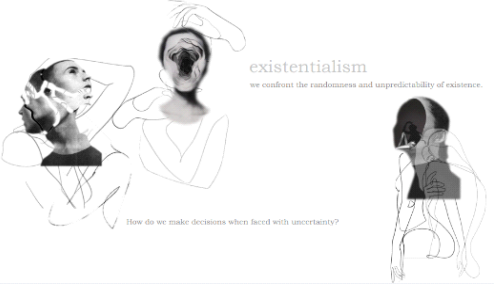
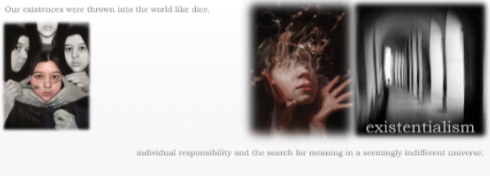




Design Stage (AI Tool Used)	Prompt / Theme	Key Idea	Visual Output
			
Design Development (DALL-E 3 + Hand sketch)	Visual reinterpretation through AI + hand sketch overlay	Asymmetric silhouettes, translucent layers	
Final Design Outcome (-)	Kaleidoscope of identity	Multi-layered design expressing psychological complexity	

Table 4. DICE of Student (S3) final design process

Design Stage (AI Tool Used)	Prompt / Theme	Key Idea	Visual Output
Problem Acceptance (ChatGPT)	Listening to 'Gyeongya' (Cello Sonata No. 1) and lecture by composer	Focus on unpredictability and symbolic moments in life and death	 <p>existentialism we confront the randomness and unpredictability of existence.</p> <p>How do we make decisions when faced with uncertainty?</p>

Design Stage (AI Tool Used)	Prompt / Theme	Key Idea	Visual Output
Idea Inspiration (ChatGPT Bing)	What is the philosophy of dice?	Dice as metaphor for decision-making and randomness	<p>Our existence were thrown into the world like dice.</p>  <p>individual responsibility and the search for meaning in a seemingly indifferent universe.</p>
Idea Expansion (Midjourney)	Design a form based on balance and unpredictability	Geometric motifs, visual chaos vs. order	 <p>DICE</p> <p>Determinism vs Free Will</p>  <p>Nevertheless, humans have the subjectivity of perception.</p> <p>Some may view certain outcomes as lucky, which others may view them as unlucky. It demonstrates that the role of subjective perception plays in shaping our experiences and attitudes towards accidental events.</p>
Design Development (Midjourney + Hand sketch)	AI visual base + manual refinement and material mapping	Blocky silhouettes, modular design layout	 <ul style="list-style-type: none"> • military • cargo • strapless
Final Design Outcome (-)	Balance in chance	Fashion piece with symbolic use of contrast and structured randomness	

accuracy, noting that current AI tools are more effective in generating atmosphere and mood rather than finalized design

blueprints. Most notably, the experts agreed that the pedagogical value of this process lies not in replacing

traditional skills, but in enhancing students' ability to think reflexively and translate multisensory inspiration into conceptual frameworks for design.

Conclusion

This study examined how the integration of auditory, linguistic, and visual stimuli—mediated through generative AI—can enhance creative engagement and conceptual depth in fashion design education. Centered around the contemporary classical composition *Gyeongya* and structured through a four-stage methodology, the research provided insights into both the pedagogical value and experimental application of multisensory learning in AI-supported environments.

From an educational standpoint, the combination of sound, language, and image functioned as a powerful catalyst for abstract thinking, emotional immersion, and conceptual expansion. The music piece *Gyeongya*, rich in symbolic and affective resonance, introduced temporal and philosophical dimensions to a traditionally visual-based design process. It encouraged students to explore themes such as life, death, and transformation while guiding their emotional engagement throughout. Linguistic thinking played a critical mediating role, as students translated auditory impressions into verbal prompts using ChatGPT to articulate and externalize conceptual responses. The iterative movement across modalities—sound to text, text to image, and image to design—fostered metacognitive reflection and deepened students' creative fluency.

Findings from the four-stage design process further validate the educational potential of this multisensory AI-assisted approach. In the Problem Acceptance stage, students engaged in open-ended music listening and a composer lecture, enhancing thematic awareness and emotional resonance. In the Idea Inspiration stage, they used AI-supported text generation to develop philosophical prompts and metaphors, broadening their conceptual frameworks. The Idea Expansion phase involved visualizing these ideas through generative AI, encouraging experimentation with unexpected imagery. In the final Design Development stage,

students integrated AI-generated imagery with personal interpretations, resulting in original, emotionally resonant design concepts, despite technical limitations of current AI rendering tools.

Implications and further research

Overall, the study suggests that a carefully structured multisensory framework—supported by generative AI—can enhance conceptual clarity, reflective design capacity, and emotional depth in creative education. Rather than serving merely as a tool, AI functioned as a co-creative partner, stimulating ideation and interpretive dialogue. However, the findings also call for critical awareness. Over-reliance on AI-generated content may standardize thinking, discourage ambiguity tolerance, and reduce authorship clarity. The opaque nature of generative models—along with embedded biases—further complicates creative ownership and outcome interpretation. While the integration of generative AI in multisensory design education offers promising pedagogical benefits, it is crucial to maintain a critical perspective on its limitations and ethical implications. The over-reliance on AI-generated outputs may inadvertently standardize creative thinking, encouraging convergence rather than divergence in ideation. Additionally, the opacity of generative models, including their data sources and latent biases, can influence aesthetic outcomes in ways that are not fully transparent to learners or educators.

Furthermore, additional research should investigate the necessity of multidisciplinary collaboration among experts in the fields of music, cognitive science, and artificial intelligence development to refine the application of multisensory learning in creative fields. In particular, while this study focused on the integration of sound (classical music), text, and image in fashion design education, future research could extend this approach by incorporating a wider range of musical genres beyond contemporary classical music. Such exploration would deepen our understanding of how diverse auditory stimuli interact with other sensory modalities to inspire creative ideation. Therefore, we anticipate that future research expanding the utilization of various sensory modalities—beyond diverse text-image generation—will enrich human–artificial intelligence collaboration and

provide a more comprehensive framework for fostering creativity in design education in the age of artificial intelligence.

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