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FROM PRODUCT TO PROCESS: EXPLORING GENERATIVE ARTIFICIAL INTELLIGENCE INTEGRATION IN L2 STUDENTS' DIGITAL MULTIMODAL COMPOSITION

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Abstract
The unique GenAI affordances for generating multiple modes have encouraged its integration into digital multimodal composition (DMC) production, with potential implications for product quality. The study aims to analyze L2 students' DMC products in three distinct courses and explore GenAI integration during the composition processes. In this descriptive qualitative study, 63 DMC products were analyzed using Hafner and Ho's (2020) process-oriented DMC assessment rubric, and the integration was explored through in-depth interviews involving 10 purposively selected designers and through documentation. The findings reveal moderate-to-high quality, ranging from a mean score of 3.27 to 4.38 across classes. The strongest performance was observed in the language dimension, with greater variability in multimedia-visual and organization-content. By course, the DMC products in Academic Writing were rated the most qualified, albeit with the highest variability, compared to those in English for Young Learners, which demonstrated more consistent quality ratings. Throughout the process, most participants critically engaged with GenAI in dynamic and iterative ways, particularly at the idea generation, referencing, editing, and design stages, displaying digital student agency. This study contributes to the role of GenAI in DMC production and how the process may potentially shape the quality and student agency, providing theoretical and pedagogical implications for relevant parties.

Keywords: digital multimodal composition, digital project-based learning, Generative AI, process-oriented pedagogy

Introduction
Twenty-first-century pedagogy has influenced how education is approached, from teacher-centered to student-centered, test-based to project-based, traditional to technology-enhanced learning, and a mixed combination of the approaches. Project-based learning (PBL) in English language learning has oriented pedagogy toward L2 learners as the center of instruction, fostering communication, critical thinking, creativity, and collaboration skills (Song et al., 2024). Through digital project-based learning (DPBL), digital student agency could be promoted as they

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critically construct meanings through identifying problems, brainstorming ideas, and thinking of solutions, mediated by digital technology (Söğüt & Hegelheimer, 2026; Stenalt, 2021; Yang & Markauskaite, 2025).

DPBL has also transformed the ways projects are designed and executed, one of which is through digital multimodal composition (DMC). Traditional monomodal composition tasks are enhanced within the digital landscape by incorporating multiple modes of communication, ranging from visual to spatial, to create effective and comprehensive meaning (Stell, 2025; Wang, 2022). An expanding number of studies has delved into the prominent role of DMC in language education, ranging from examining its benefits on motivation (Jiang & Luk, 2016), creativity (Yu et al., 2026), and autonomy (Xie & Jiang, 2025) to assessing the product (Hafner & Ho, 2020; Zhang & Yu, 2024).

Despite the expanding concept of composition in digital-based pedagogy, DMC projects are mostly implemented in written composition courses (see Smith et al., 2025; Yu et al., 2026), while studies exploring DMC projects in non-writing-oriented courses are relatively underexplored, particularly considering that different disciplines may require different types of DMC tasks (Kessler, 2022). Xia and Li (2026) highlight the role of DMC projects in content-oriented courses as they potentially improve disciplinary knowledge through incorporating multiple modes in authentic contexts to construct meaningful knowledge and how they can support language outcomes beyond writing (Talakoob et al., 2025). Non-writing settings where DMC-related research has been conducted include, for example, a speaking skill course (Talakoob et al., 2025; Zhussupova & Shadiev, 2023) and content-oriented ones (Jiang et al., 2024; Xia, 2024). Beyond promoting students' 21st-century skills, incorporating DMC projects into a variety of courses is believed to help shape their digital literacy skills to thrive in today's digitally driven world (Jones & Hafner, 2021; Wu & Zhang, 2025; Xia, 2024).

GenAI integration in digital multimodal composition process

The emergence of digital technologies has transformed how meaning is constructed. In the pre-digital technology era, meaning was made by relying on one or two modes only, with the linguistic mode as the dominant one, but digital technologies have made it possible to present meaning in modes beyond linguistic, ranging from visual to gestural modes (Kessler, 2022). The incorporation of digital multimodality in meaning-making, while enhancing learners' digital literacy, has enriched their knowledge of how meaning is constructed and communicated by taking into account audience and purpose (Hafner, 2014).

DMC is produced through several stages. Hafner and Ho (2020) propose four main DMC production stages: pre-design, design, sharing, and reflecting, each of which comprises sub-stages. In pre-design, for instance, learners generate ideas and plan content, while the design stage involves developing relevant modes to support the linguistic mode and integrating all the modes into one DMC product. Jiang and Lai (2025) further extend the stages by incorporating GenAI into the production, resulting in a recursive process.

The GenAI invention has infiltrated numerous domains, including language education, to facilitate learning. Language learners use GenAI to gain feedback on their language production (Jiang & Lai, 2025), act as a conversational partner or tutor (Sok & Shin, 2025), or generate language exercises for independent study

(Abdelhalim & Alsehibany, 2025). The rapid innovation of GenAI tools has also transformed DMC production processes, which could potentially enhance overall quality, albeit it is relevant only in several dimensions (Hafner & Ho, 2026; Jiang & Lai, 2025). During the pre-GenAI DMC era, L2 learners relied on their creativity and digital technical skills to produce multiple modes for DMC texts by utilizing non-AI digital tools such as Canva, Adobe Photoshop, or Corel Draw (Jiang & Luk, 2016; Stell, 2025). Current GenAI affordances in generating multimodal resources, ranging from images to videos, have benefitted learners in crafting DMC products (Hafner & Ho, 2026; Moorhouse et al., 2026).

However, these affordances have led to skepticism about the DMC effectiveness in shaping students' critical thinking, creativity, and problem-solving skills (Hafner & Ho, 2026; Smith et al., 2025). Studies reveal how AI-generated outcomes are taken for granted to complete DMC tasks, leading to students' over-reliance on AI and cognitive apathy (Perkins, 2023; Zhai et al., 2024). Cognitive apathy reduces motivation to engage in cognitive activities, such as critical thinking, problem-solving, and independent reasoning, which may manifest in AI-assisted learning when students accept AI-generated answers without verifying their accuracy, evaluating supporting evidence, or developing their own ideas. These ethical concerns may continue to rise unless appropriate measures are taken (Kostopolus, 2025).

Others favoring its integration view GenAI as an ally to provide students with opportunities to critically engage with GenAI to facilitate their DMC production, thus creating positive human-AI co-creation (Yang & Markauskaite, 2025; Zhao et al., 2025). However, studies on AI integration exploring the human-AI interaction process in DMC production are relatively limited (Hafner & Ho, 2026). Previous studies on pre-GenAI DMC were mostly centered on the human approach while leaving out AI use and its potential affordances in facilitating DMC production, which could reshape literacy learning (Lim, 2026) and learner agency (Söğüt & Hegelheimer, 2026).

Meanwhile, limited studies on GenAI integration highlighting human-AI collaboration have been undertaken (Moorhouse et al., 2024; Su et al., 2023; Yang & Markauskaite, 2025), examining how this collaboration could be applicable across contexts. Yang and Markauskaite (2025) address four types of student teachers' agency that gradually develop during AI integration: *embryonic, emerging, evolving, and expanded*. *Embryonic* agency emerges when students evaluate mismatches between expectations and the generated products and revise prompts for better product quality. Students' agency shifts to the *emerging* stage when they have learned how to use GenAI, as evidenced by better prompts and improved product quality. In *evolving* agency, students integrate pedagogical ideas with GenAI affordances and make decisions when (not) to use GenAI. This agency transforms into *expanded* agency when GenAI is treated beyond the technical skills and uses, for instance, in relation to GenAI's role in shaping professional goals and concerns about the ethical use of GenAI. Su et al. (2023), furthermore, explore human-GenAI integration throughout writing process stages and the opportunities for its application in the DMC production due to the shared process stages involved. It is, hence, pivotal to explore how learners incorporate GenAI into the DMC process to identify how GenAI participates during the multimodal making and how

students' agency and critical thinking is shaped through problem solving and decision making during the process.

Across studies, GenAI fulfills several recurring functions. At early stages, it supports idea generation and planning through brainstorming topics, outlining narratives, and generating sample scripts (Lin et al., 2025). During drafting and revision, GenAI is predominantly used for language support, including grammar correction, vocabulary enhancement, paraphrasing, and translation. This concentration of AI use around linguistic refinement aligns with findings in which language dimensions of DMC products are consistently stronger than multimodal ones (Kim et al., 2025). GenAI is also employed for feedback and revision, offering suggestions related to clarity, structure, and tone that facilitate iterative improvement (Cotelli Kureth et al., 2025). The current GenAI affordances in generating multimodal resources have also provided added value in shaping DMC product quality (Hafner & Ho, 2026; L. Jiang & Lai, 2025; Moorhouse et al., 2026). However, studies investigating GenAI's role in the DMC process remain comparatively limited. While some learners use AI to generate images or explore visual–text relationships, studies report that such use is sporadic and often constrained by limited prompting skills and uncertainty about aesthetic and rhetorical appropriateness (Hafner & Ho, 2026; Hwang et al., 2025; Lin et al., 2025). This uneven functional distribution helps explain why multimodal-visual quality improves less than the language aspect.

Current studies have leaned toward GenAI integration in DMC production. Jiang (2024) and Smith et al. (2025), for example, investigated the integration process by university students in L1-based literacy courses with teacher intervention and their perceptions of its use. Likewise, most studies in the area observed the GenAI integration process in L2 writing contexts with, to some extent, teacher interventions or scaffolding (Li et al., 2025; Lin et al., 2025). These studies have contributed to the AI-mediated DMC literature, but the findings may not portray learners' authentic utility of GenAI and thus have not reflected their AI competency and the actual use of GenAI tools in the DMC production process. Hence, research on pedagogical AI integration with little to no intervention is needed to portray authentic use of GenAI under limited scaffolding, so more targeted interventions could be designed.

The quality of GenAI-mediated digital multimodal composition products

Prior studies have shed light on GenAI integration during the DMC production process and revealed the diverse ways GenAI is used during the composing process. However, most studies left out the DMC product assessment in the investigation, whereas GenAI use could potentially shape the product quality (Jiang & Lai, 2025; Smith et al., 2025). Research indicates that AI-enhanced DMC products developed by L2 learners generally demonstrate quality comparable to, and often exceeding, that of non-AI or traditional compositions, particularly in language dimensions, such as grammatical accuracy and vocabulary use, and organizational dimensions, such as integration of text and visual elements. Jiang and Lai (2025) compared the DMC development processes and products of GenAI-assisted and non-GenAI-assisted groups in an English classroom setting. The former outperformed the latter in most DMC outcomes, yet the teacher scaffolding might affect the authentic process of GenAI integration.

In determining DMC quality, studies employing explicit process–based frameworks, multimodal rubrics, and staged guidance demonstrate more balanced product quality across linguistic and multimodal dimensions (Hafner & Ho, 2020; Jiang & Lai, 2025). However, to achieve high quality in all dimensions, pedagogical scaffolding is required. When scaffolding is limited, students tend to prioritize linguistic polish, often supported by AI editing tools, over deeper multimodal meaning-making, resulting in products that are linguistically strong but multimodally underdeveloped (Jiang & Lai, 2025). Likewise, insufficient scaffolding in using AI may also lead to students' academic dishonesty, particularly in the context of intellectual property (Kostopolus, 2025). This recurring pattern suggests that observed quality differences in AI-enhanced DMC products are less attributable to AI itself than to instructional design and students' AI literacy. Hence, non-teacher intervention studies are worth investigating to observe authentic utilization of GenAI that may contribute toward the AI integration process and GenAI-mediated DMC product quality.

The present study

Positioned within this literature, the present study responds to the need for integrated product-process analyses of GenAI-enhanced DMC in varied instructional contexts by shifting the orientation from product to process to portray the authentic processes of the GenAI integration and how it shapes students' DMC products and agency. Investigating the process in the absence of teacher intervention is essential to descriptively identify the students' AI competencies and choices made, reflecting their true critical AI literacy (Smith et al., 2025), so careful pedagogical measures can be designed to foster the integration. Furthermore, incorporating DMC projects in three diverse pedagogical contexts: Academic Writing (AW), Intercultural Listening (IL), and English for Young Learners (EYL) into the current study is aimed at investigating how GenAI-assisted DMC is also applicable in diverse pedagogical contexts. By analyzing both the quality of DMC products and GenAI integration across composing stages, this study extends prior work by illuminating how critical AI literacy and course-specific pedagogical priorities jointly influence the quality of L2 digital multimodal composition.

Building on the previous process-product-oriented studies, the current study aims to analyze L2 students' AI-enhanced DMC products across courses and the integration of GenAI into the DMC production process. This study poses two central research questions:

1. How is the quality of L2 students' AI-enhanced digital multimodal composition (DMC) products across courses?
2. How do L2 students integrate GenAI while composing digital multimodal products?

Unlike previous digital tools, the unique affordance of GenAI tools in generating multimodal products underscores the paramount role of this digital tool as an active participant in the meaning-making production. Hence, the concept of DMC applied in this study, adapted from Smith et al., (2022), Wang (2022), and Lim (2026), also incorporates the use of GenAI tools in the form of a task in which L2 learners develop a digital written and/or oral text by incorporating multiple modes of communication mediated by GenAI and/or non-AI digital tools to construct meanings. The digital texts produced are not restricted to print-based

written texts but include other forms and genres, from digital videos to infographics, treated as projects assigned to L2 students of English in three different courses at a public university in Indonesia. The context of Indonesia may also bring distinct findings due to its unique challenges, ranging from a large geographical area to its demographic profile. These challenges could be strong indicators of digital divides due to uneven digital technology access and digital literacy (Idris & Amalia, 2025) and language teachers working in resource-constrained educational settings (Wang, 2025). Furthermore, most studies on pedagogical GenAI integration have taken place in Global North countries such as China and Western countries, which may not share similar characteristics found in Global South countries, such as Indonesia. Hence, having Indonesia as the context representing the latter would contribute to the limited research on pedagogical GenAI integration in this setting.

This study contributes to the growing field of study on GenAI integration in DMC, particularly on how the integration, with minimal intervention and low resources, may potentially shape the DMC quality, students' AI competency, and digital student agency, which are relatively underexplored. Examining both products and processes is critical to understand how quality may reflect composing practices and how GenAI may contribute throughout the process, especially when no consensus exists on GenAI's contributing role across DMC dimensions and stages (see, for example, Jiang & Lai, 2025; Moorhouse et al., 2026). Pedagogically, the findings may assist language educators and curriculum designers in integrating AI literacy education into the curriculum by developing more targeted intervention programs focused on specific areas of underdeveloped AI literacy and competency dimensions. The study is also expected to support schools and policy makers to provide more supporting resources for teachers and students, among which, by providing AI literacy trainings, for effective pedagogical integration.

Method

Research design

This study employed a descriptive method supplemented by descriptive statistics to analyze the quality of the GenAI-assisted DMC products, whose designers were subsequently selected for in-depth interviews to explore the GenAI integration during production. The research design adheres to a descriptive qualitative approach, as it "studies something in its natural state and does not attempt to manipulate or interfere with the ordinary unfolding of events" (Colorafi & Evans, 2016, p. 2). It seeks to capture and portray the subjective experiences and insights of the participants engaging with GenAI tools in their DMC-based learning environments. Employing a qualitative strategy allows researchers to delve deeply into the nuances of participant interactions with GenAI, facilitating a richer understanding of the integration in their composition process and any gains from the integration (Creswell & Creswell, 2023).

Setting and participant

The study was carried out at an English language teaching department of a public university in East Java, Indonesia. Sixty-three DMC products were collaboratively designed as group projects and collected from three different courses: academic writing (AWa = 14 products; AWb = 16 products), intercultural listening (IL= 23 products), and English for Young Learners (EYL = 10 products).

The former represents the writing context, while the rest are the non-writing context (language-based and content-based courses, respectively). Next, 10 participants, with high-quality products, were selected for in-depth interviews.

All the courses assigned differing DMC projects, subject to the course objectives. They also followed the stages in the DMC production process in which GenAI could be incorporated. In AW, however, GenAI was prohibited at the *drafting stage* to ensure the originality of the students' essays, which was the highlight of the course. Limited teacher intervention on how to use GenAI was made by providing the ministry-published guidelines on the ethical use of GenAI. All courses but IL provided guidance to the students on how to create a DMC. Similarly, all courses, but EYL, encouraged the students to disseminate the product through social media (AW) or *Google Sites* (IL). The detailed information regarding the DMC project in each course is addressed in Table 1.

Table 1. Gen AI-integrated DMC process in three distinct courses

Class	Total Products	GenAI-integrated DMC Process
AWa	14	- Converting a conventional argumentative essay into a DMC-formatted text of any forms - Applying all production process stages except *the drafting stage* - Giving limited intervention on how to use AI for DMC (a guideline on ethical AI use was provided) - Providing guidance on how to design a DMC product - Providing a writing conference for teacher feedback on the product - Disseminating the DMC products on social media, e.g., *Instagram, TikTok*
AWb	16	
EYL	23	- Converting a conventional reflection report into DMC-formatted slides or magazines - Applying all production process stages - Giving no intervention on how to use AI for DMC - Providing guidance on how to design a DMC product
IL	10	- Converting audio-visual materials into DMC-formatted visual texts of any form - Applying all production process stages - Giving no intervention on how to use AI for DMC - Providing guidance on how to design a DMC product - Disseminating the DMC products on *Google Sites*

Data collection and analysis

Upon receiving approval from the research ethics committee (No. 05037/DST/UN10.F1201/B/PT/2026), the researchers began collecting the data. The data collection occurred in two phases to ensure thoroughness and reliability: the product and process phases. In the product phase, students were collaboratively assigned to produce GenAI-induced DMC products, subject to the courses' terms

and conditions, as their final project across Academic Writing (AW), Intercultural Listening (AL), and English for Young Learners (EYL) courses. In AW, pairs first developed argumentative essays through a process-writing approach, with GenAI use restricted to idea generation and language mechanics support. Upon receiving lecturer approval, they converted the essays into multimodal products, ranging from blog posts to e-magazines, supported by GenAI, to be later submitted to Google Classroom and posted on students' personal social media. In IL, groups explored audio or audiovisual materials and were assigned to recreate the materials into two connected outputs: a visual publication, such as an e-poster or brochure, and a recorded video presentation explaining the visual. GenAI was permitted for outlining, template assistance, and illustration. In EYL, groups of four initially designed and delivered English lessons in partner schools, documented their teaching in written reports, and subsequently designed reflective digital magazines integrating narratives, visuals, and design elements prior to submitting them through *Google Classroom.* Thus, the three group projects situated DMC within argumentative essay writing, listening-based interpretation, and teaching practice reflection, respectively.

After collection, to answer research question 1, the DMC products across courses were assessed for quality checking via descriptive statistics with the adapted rubric by Hafner and Ho (2020) because of its shared process orientation and applicability in assessing various forms of DMC products (see Hafner & Ho, 2020; Jiang & Lai, 2025; Pham & Li, 2023). It entails three dimensions: organization-content, multimedia-visual effects, and language, on a scale of one to five. In addition to collecting the raw scores of the products, the mean and standard deviation scores obtained from each class were also collected to identify the overall performance of the groups in their GenAI-assisted DMC products. To find the reliability score, two raters independently assessed the DMC products, and inter-rater reliability was calculated to determine the level of agreement between them using a two-way random effects intraclass correlation coefficient (ICC) for absolute agreement. The analysis of 63 DMC products yielded an ICC of .871 (95% bootstrap CI [.792, .925]), indicating good inter-rater reliability. All the scores were then discussed among the researchers for reliability checking, and any disagreement was further resolved to reach agreement.

The results of the assessment were subsequently used as considerations in selecting the participants for an in-depth interview (see Figure 1). Only those with the high quality of DMC products in the three dimensions were selected for the interview because of the perceived justification that high-quality DMC products may incorporate extensive GenAI integration, as reflected in Jiang and Lai (2025). In addition to the high-ranked products, the consideration of the participant selection was based on the unique results of the reflection analysis, ranging from using GenAI in almost all stages to barely using it during the process. Prior to the interview, they gave their informed consent by filling out a consent form, informing them of the anonymity of their identity and data confidentiality.

To address research question 2, in this process phase, synchronous semi-structured interviews via *Zoom* were held to capture how the participants engaged with GenAI tools during the DMC production process across stages. The stages adapted Hafner and Ho's (2020) process-based model, comprising pre-design, design, and reflect/revise stages, and were extended or broken down into more

stages, subject to the participants' emerging GenAI integration process. The display stage was removed from the model since the practice did not incorporate GenAI in that stage. Besides the interviews, GenAI conversation logs comprising the prompts and generated outputs were also submitted for evidence and analysis of the participant-AI interactions. The results of the audiovisual-recorded interviews were then transcribed verbatim for a content analysis.

The analysis of collected qualitative data followed a thematic approach, focusing on identifying and interpreting patterns, themes, and significant insights emerging from the participant narratives. Four themes were addressed, comprising GenAI integration across stages, GenAI uses, challenges in GenAI use, and student agency. Yang and Markauskaite's (2025) transformative agency framework for student teachers was utilized to analyze the type of student agency the participants exercised during GenAI integration in DMC production. Thirteen coding categories were set across the four themes (Table 2). Two research assistants, who had previously been trained on the coding protocol for the dataset, performed the preliminary coding analysis. They collaboratively coded the dataset, and their coding was later reviewed and discussed with the researchers. When coding disagreements occurred, for instance, on which type of student agency the participants were exercising, further analysis and discussion were conducted to settle the disagreement. The other data sources, such as the participants' GenAI logs and reflection forms, were used to triangulate the interview and product quality data to help resolve the disagreement.

Table 2. Coding schemes for GenAI stages, GenAI use, challenges, and student agency

Coding	Explanation	Examples
T1. GenAI stages		
Pre-design	Idea generating, referencing, outlining, drafting.	- *We asked GenAI to generate potential topics for the essay.* - *Our group had GenAI recommended several references to support our topic.*
Design	Generating supporting modes, arranging resources, integrating multiple modes into a DMC product.	- *GenAI changed the uniform portrayed in the uploaded image based on the given prompt*
Reflect	Providing feedback for quality improvement, revising DMC product.	- *The DMC product was then uploaded onto GenAI to gain feedback for improvement.*
T2. GenAI use		
Content generation	To generate ideas, references, supplementary content.	- *GenAI helped narrow the topic from abundant online information to the issue regarding compulsory school uniforms.*
Feedback and revision	To request feedback, revision, suggestion.	- *Our group read generated corrections, copied suitable wording, and added instructions when the wording did not fit.*
Critical thinking	To evaluate accuracy, relevance, and to make decision (accept, revise, reject, verify).	- *The song recommendations given by GenAI were doubtful, so we decided to choose manual searching instead.*

Coding	Explanation	Examples
Mode representation	To generate, edit, and integrate modes (e.g. images, video, DMC template) into DMC.	- *We used Gemini for generating images and Canva for placement and design.*
T3. Challenges Ethical	Concerns about authorship, plagiarism, copyright.	- *We were worried about plagiarism and copyright when using GenAI-generated images and other creative work.*
Technical	Difficulties with prompting, output reliability or suitability, access to GenAI tools, integration of generated content.	- *Useful scholarly material or a search route was inaccessible or required payment, including when using Consensus.*
T4. Student agency Embryonic	Evaluate mismatches between expectations and the generated products, revise prompts for better product quality.	- *Clothing details were added through repeated prompts after an unsuitable generated image.*
Emerging	Learn how to use GenAI, produce effective prompt.	- *We found difficulties writing image prompts and seek prompt-writing examples on Instagram.*
Evolving	Integrate pedagogical ideas with GenAI affordances, decide when (not) to use GenAI.	- *Our group consulted GenAI about ways to engage Grade 2 pupils and select teaching media.*
Expanded	Reconsider professional roles, ethical responsibilities	- *We realize the importance of GenAI in education, so we need to keep up with the technology advancement for our future teaching*

Findings and Discussion

This section reports the qualitative findings regarding the DMC product quality and the GenAI integration in the production process. The findings are discussed to respond to the research questions and theoretical underpinnings used in the study. Some implications and recommendations are also postulated.

Findings

The findings are classified into two phases, the Product and Process phases, to address the research questions. The product phase presents the findings regarding the quality of the DMC products across classes, while the process phase focuses on the ways the participants engaged with GenAI during the DMC production process.

Product phase

In this first phase, the participants' products were analyzed using the DMC rubric by Hafner and Ho (2020), comprising organization-content, multimedia-visual effects, and language dimensions on a scale of 1 to 5 across classes. Table 3

presents the mean and SD scores of the participants' DMC products in three distinct classes (two classes of Academic Writing (AWa/AWb) Course, one class of English for Young Learner (EYL) Course, and one class of Intercultural Listening (IL) Course.

Table 3. Descriptive statistics for *DMC product quality in three distinct courses*

Class	Organization Content		Multimedia Visual Effects		Language	
	M	SD	M	SD	M	SD
AWa	3.27	0.79	3.53	0.64	3.87	0.64
AWb	3.87	0.34	4.00	0.73	4.31	0.60
EYL	3.9	0.57	3.8	0.42	4.1	0.57
IL	3.54	0.66	3.54	0.52	4.38	0.51

The findings reveal that the products' mean values are within the range of 3.27 and 4.38, indicating moderate to high quality. In terms of organization and content, the products are at a similar average quality level across classes, with AWa having the lowest quality and greatest variability (M = 3.27, SD = 0.79). Meanwhile, a relatively consistent result was observed in the language dimension (all SDs below 0.65), with IL achieving the highest mean score (M = 4.38, SD = 0.51) while AWa had the lowest (M = 3.87, SD = 0.64). More diversity in quality and heterogeneity was found in the use of multimedia and visual effects in the DMC products. AWb performed the most qualified use of multimodality, although with greater variability (M = 4.00, SD = 0.73). Compared to AWb, EYL achieved slightly lower qualified, yet more consistent, multimodal use (M = 3.80, SD = 0.42). Despite the overall moderate to high quality of the DMC products, the most notable strength was found in the language, followed by the multimedia-visual effects and organization-content dimensions, respectively.

To describe the GenAI integration process in the DMC production, ten high-quality DMC products intricately designed by ten groups of participants across classes were carefully selected. Two samples in Figures 2 and 3 were retrieved from AW and EYL DMC projects, respectively. Both were in a digital magazine format and gained high scores in the three dimensions.



Figure 2. DMC product sample from AW Class

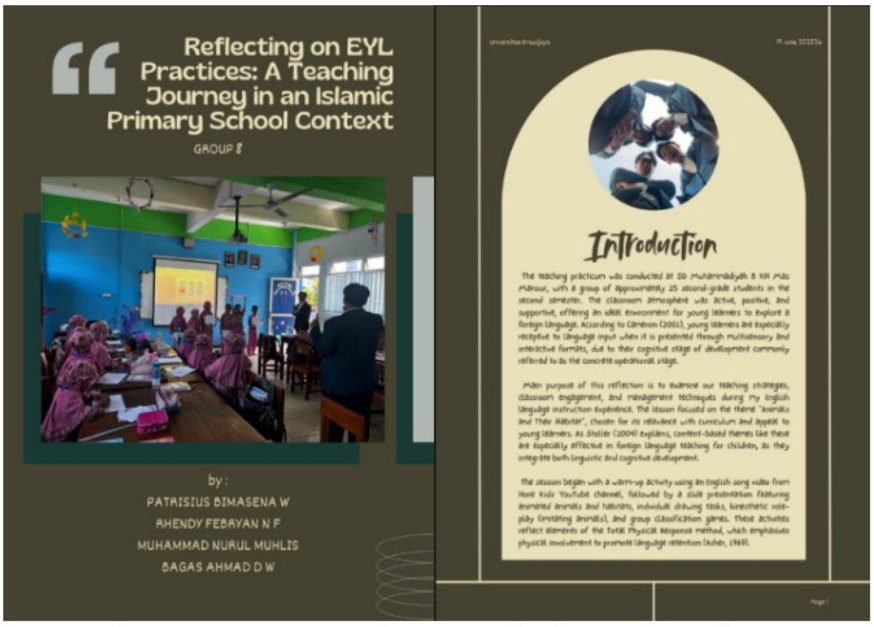


Figure 3. DMC product sample from EYL Class

Although the digital templates are easily accessible from the internet or generated by GenAI, thus avoiding designing from scratch, this magazine format was the least favorite among the groups in AW due to its complexity, making it one of the most intricate across all DMC forms. The magazine-formatted DMC required the participants to include not only the assigned verbal text but also other aligned supporting texts and the various modes, ranging from visual to spatial, to complete the finished product. Rey asserted that it was because of "our love of designing"

that led her team to choose the magazine format, in which they could design suitable modes to add meaningful touches to their verbal text. Hence, the groups choosing this format gained the highest scores, particularly for the multimedia and visual effects dimension.

To conclude, despite the overall moderate to high quality of the DMC products, the most notable strength was found in the language dimension, particularly in terms of grammatical accuracy, vocabulary use, and sentence construction, followed by the multimedia-visual effects and organization-content dimensions, respectively. Some of the most chosen DMC forms for the projects include digital slides and posters, particularly since both were the recommended ones for EYL and IL projects. The group representatives of the selected products were then invited for an in-depth interview to delve into the GenAI integration in the DMC production, which will be further discussed in the *Process phase.*

Process phase

Each group representative was invited for a synchronous interview via *Zoom* after filling out a consent form (see Table 4 for the profile). The interview explored the ways the designers integrated GenAI. The results of the analysis reveal emerging stages expanded from Hafner and Ho's original stages into seven DMC production stages: *idea generating, outlining, drafting, referencing, editing & proofreading, designing, and revising & reflecting*. All the selected participants had experience in DMC production and integrated GenAI tools during the process, to a greater or lesser extent. A few of them have been familiar with and used GenAI tools on a daily basis. Several common tools the designers utilized during the process were *ChatGPT, Gemini,* and *Consensus,* all of which were the free versions.

Table 4. DMC group designer profile

Designer*	Class	Topic	DMC Form
Rey	AWb	studying in a cafe	e-magazine
Nay	AWb	English as a medium of instruction	slides
Aza	AWb	school uniform	e-magazine
Nas	AWa	teaching English the local way	e-magazine
Mel	AWa	full-day school system	e-magazine
Ben	EYL	EYL teaching practice reflection	slides
Roz	EYL	EYL teaching practice reflection	slides
Fan	EYL	EYL teaching practice reflection	e-magazine
Pey	IL	sustainable fashion	e-poster
Hay	IL	sustainable transportation	e-poster

*group representatives in pseudonyms

The findings reveal the iterative patterns of GenAI integration during the DMC production and the GenAI contribution level in each stage along the process, summarized in Figure 4 and Table 5, respectively.

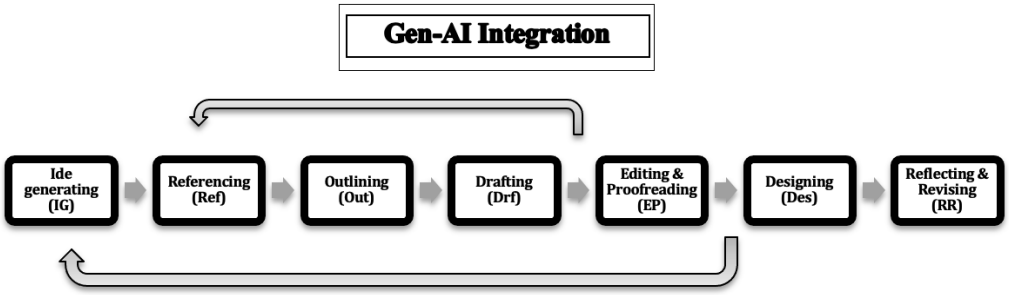


Figure 4. GenAI integration across DMC production process stages

Figure 4 illustrates how GenAI was integrated in a dynamic and non-linear way, instead of sequentially from the idea generation to the reflecting and revising stage. Several stages, such as *idea generating (IG), outlining (Out),* and *editing & proofreading (EP)*, involved GenAI assistance in the processes, while stages like *idea generating (IG)* and *referencing (Ref)* were revisited by some designers to generate a new idea or references for different purposes from the original stages. For instance, after *drafting (Drf)*, several participants went back to *referencing (Ref)* for GenAI-recommended references to support their arguments prior to editing and *proofreading (EP)*. Likewise, an interruption occurred after *EP* when the participants reverted to *idea generating (IG)* to collect ideas for the multiple modes.

Table 5 presents the distribution of GenAI integration into the DMC process across stages. Each group incorporated GenAI tools to a greater or lesser extent. Several participants integrated GenAI in most stages, while others decided not to use GenAI-generated content for several reasons, such as the results not meeting their expectations. The detailed AI integration process in each stage is presented in the next section.

Table 5. Summary of GenAI integration in DMC production process phase across courses

Designer	Class	IG	Ref	Out	Drf	Re-Ref	EP	Re-IG	Des	RR
Rey	AWb	■	▒	■			■			
Nay	AWb	■	▒	■			■	■		
Aza	AWb	■	▒	■			■	■	■	■
Nas	AWa			■		■	■		■	■
Mel	AWa	■					■			■
Ben	EYL	■								
Roz	EYL	■	■	■	■		■	■	■	
Pey	IL	■	■	■	■	■	■			
Fan	EYL	■			■		■		■	
Rah	IL	■		■	■					

Note:
□ : No GenAI use ■ : Full GenAI use ▒ : Average GenAI use

Idea-generating stage

In this stage, designers brainstormed ideas they planned to use for the written composition part (linguistic mode) of their DMC product. All the designers except Nas used GenAI to generate ideas for their DMC product. They started by inserting a prompt into the GenAI, and it generated a list of ideas for them to choose from. Next, they decided with the team members which idea would be most feasible to be further developed for the product. Nas, however, skipped GenAI integration at this stage since she and her team had decided on an idea for their product and moved directly to the referencing stage.

Referencing stage

Although most designers employed GenAI for finding references, they responded to the generated references differently. The designers inserted a prompt requesting GenAI to present a list of relevant references to support their paper. However, Rey, Nay, and Aza did not proceed to explore the references, as they found that most of the GenAI-generated references were false or did not exist, and decided to use web-based platforms like *Google Scholar, ResearchGate,* and other academic reference-searching tools on the internet to find the references. Nay, for instance, admitted that using GenAI was a waste of time for this referencing purpose due to its hallucination and thus decided to skip GenAI, as illustrated in the excerpt below:

> *After GenAI generated the references, we checked the references one by one, and as predicted, most of them were fake, so we didn't want to waste our time and went to what we've always used, Google Scholar and ResearchGate, for references* (Rey-AWb, Ref).

Likewise, Nas, who skipped GenAI at the idea-generating stage, continued not using GenAI at this stage and used *Google Scholar* for references.

Outlining stage

Some designers like Rey and Roz further prompted GenAI to generate an outline for their paper based on the idea selected. They then analyzed and modified the generated outline to suit the template of their project. Interestingly, Mel, Ben, and Fan did not use the tool for this purpose for a variety of reasons. Mel, for instance, directly developed the idea into the essay template provided by the lecturer, while Ben, although initially using GenAI for outlining, decided to proceed to the rest of the phases by excluding GenAI from the process altogether because he was dissatisfied with the generated outputs, which he referred to as "time-wasting."

Drafting stage

At this stage, only few designers, all of whom were from EYL and IL classes, employed GenAI for drafting the content. Roz, for instance, asked ChatGPT to generate one of the sections in the first draft of the paper (*prompt: Create students engagement and learning*) in *Bahasa Indonesia* based on the EYL lesson plan and reflection logbook she and her team created and uploaded into ChatGPT (see Figure 5).

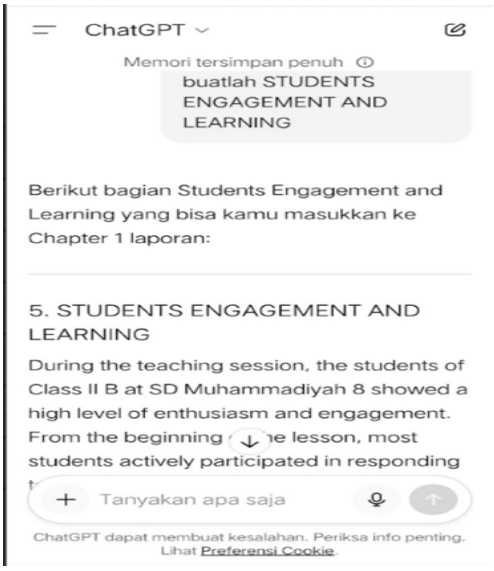


Figure 5. Roz' prompt for drafting

Roz claimed that it was ethical to do so since all the data uploaded were authentically theirs, as the following excerpt illustrates:

> *It is fine because we designed the lesson plan and reflection logbook ourselves, so we only asked GenAI to generate the first section of our product as an illustration before writing the rest of the sections* (Roz-EYL, Drf)

Next, they analyzed the generated draft, made some revisions, and rewrote the draft before uploading it back to GenAI for mechanical checking. None of the designers from AW classes utilized GenAI at this phase since the drafting activity was done manually, and any digital tools, including GenAI, were strictly prohibited for the purpose.

(re-)Referencing stage

Some designers like Nas, Roz, Pey, and Fan revisited the reference stage by inserting a prompt together with their arguments taken from the text and having GenAI generate relevant references to support the arguments. The others did this manually and/or used reference management tools like *Mendeley* or *Zotero* to ease them with citing and listing references.

Editing and proofreading stage

This is the stage when most designers ask GenAI to edit and proofread their draft by checking the grammar, finding correct vocabulary and expression, paraphrasing, and proofreading the mechanics, like punctuation and capitalization. To do this task, most participants turned to using AI writing tools like *Grammarly* and *QuillBot* instead of GenAI, although the two tools also provide their GenAI features (Grammarly, 2026). The activity was done by uploading the draft onto the tool and having it checked for accuracy and clarity.

(re-)Idea Generating stage

Some designers like Roz, Nay, and Aza went back to the idea-generating phase and had GenAI provide them with suggestions on what modes they could incorporate into the product to support the written composition and how they should be organized. The generated ideas were then analyzed and modified to suit the topic and design style, as Nay illustrated in the excerpt below:

> *We asked GenAI for help to give us ideas on the modes because we didn't have enough clues on how to design a DMC product. Then, we selected which ideas could be best put into our work. Next, we used Canva to design the mode based on GenAI's suggestion* (Nay-AWb, re-IG)

Meanwhile, Roz and her team had *Gemini* generate a sample of a multimodal product (see Figure 6) based on the reflection draft, logbook, and lesson plan to inspire them in designing their own.

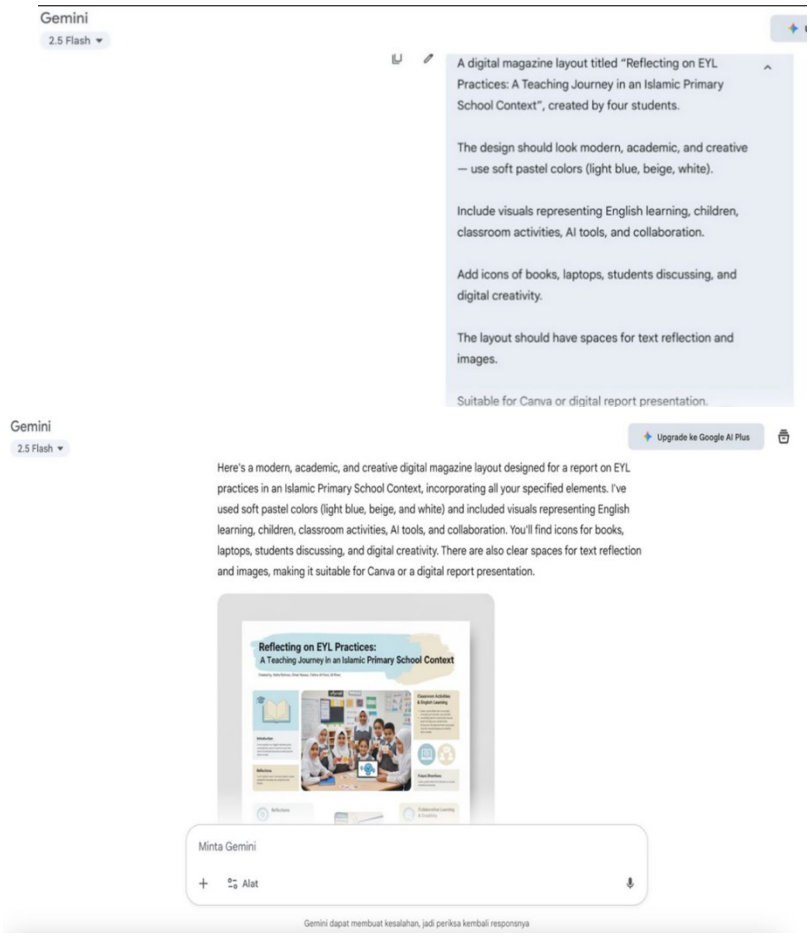


Figure 6. Roz' idea-generating prompt and its *Gemini*-generated outcome

Designing stage

This is the core stage of the multimodality production process in which the multiple modes like visual, audio, spatial, and gestural are designed and integrated into one DMC product. While GenAI could assist the designers in generating the

modes, only a few fully utilized the tool for this purpose. Nas, for instance, initially attempted to generate an image to support her group's essay but failed since the generated image was not what they expected (see Figure 7).



Figure 7. Nas' image generated by ChatGPT

Nas had *ChatGPT* generate an image to represent the group's idea about local culture in ELT in the written composition. Some features displayed in the generated image, as illustrated in Figure 7, might have represented the Indonesian local culture-infused ELT setting, such as the topic written on the board and the Indonesian-like human characters, but the traditional outfit *kebaya* worn by the teacher character was considered "a little overboard." Instead of re-prompting to have more relevant images generated, they decided to exclude the image from the DMC product and searched for a more suitable one instead on *Pinterest*.

Meanwhile, Aza succeeded after several prompting attempts, as presented in Figure 8.



Figure 8. Aza's GenAI initial image (left) and modified image (right)

Aza had *Gemini* generate an image of a schoolboy wearing a uniform, but the generated image produced a casual outfit instead (left image), so they re-prompted several times to have GenAI modify the image portraying the boy wearing an Indonesian senior high school uniform (right image).

Reflecting and revising stage

This is another crucial stage of the multimodality production process in which the finished DMC product with its integrated modes is checked with GenAI for feedback. Designers revisit the DMC product by reflecting on the written composition and all the supporting modes. Three designers managed to reach this final stage of the GenAI-enhanced production process. Nas, Aza, and Mel uploaded their finished DMC product and requested feedback from the tool to guide them in modifying and revising the product before submission.

Discussion

This study offers a narrative description of the L2 students' authentic utility of GenAI integration with limited intervention during the DMC production process and how it may shape the product quality across courses. The discussion first examines the quality of L2 students' GenAI-enhanced DMC products across courses and then explores how they integrate GenAI into the composing process. The theoretical and pedagogical implications, as well as the limitations and directions for further research, are also postulated.

DMC product quality in GenAI-mediated settings

The first notable finding concerns the overall quality of the DMC products, which was at a moderate to high level, with the language dimension scoring highest, corroborating Kim et al (2025), followed by multimedia visual effects and content organization, respectively. Concerning GenAI integration, this pattern may stem from common AI support tools, e.g., *Grammarly,* for refining language mechanics. The tools have long assisted learners in producing mechanically better text quality, although the organization dimension may also benefit from the tools, as reflected in Lin et al's (2025). However, the comparisons in the current study are purely descriptive, and thus should be treated tentatively, as distinct quality patterns are found in other DMC production settings (see Jiang & Lai, 2025; Li & Pham, 2025; Lin et al., 2025). Li and Pham (2025), for instance, report differing levels of DMC product quality from collaborative vs. individual work, in which the former excelled in the multimedia dimension while the latter benefitted in the content/organization dimension, with no significant difference in the language dimension in either work. This finding highlights the crucial need for pedagogical scaffolding, as insufficient scaffolding may lead students to prioritize linguistic polish over deeper multimodal meaning-making, resulting in products that are linguistically strong but multimodally underdeveloped (Jiang & Lai, 2025).

The quality of DMC products has also yielded mixed results across courses. The findings reveal the differing quality of DMC even within the same course, as in AWa and AWb, with the latter outperforming the former and the other two courses across dimensions. While the language and content-organization dimensions were expected to improve in AWa and AWb (Lin et al., 2025) because more attention was given to both dimensions during production, the results conflicted, particularly with AWa receiving the lowest mean score among the other courses. That IL obtained the highest mean score in the language dimension adds divergent insights to the findings. This descriptive variation may potentially highlight other contributing factors such as learner characteristics and composing

practices, in addition to course and task designs, in DMC production (see Choi et al., 2026; Hafner & Ho, 2026; Jiang & Lai, 2025; Li & Pham, 2025).

The question of the role of GenAI in shaping DMC product quality is also noteworthy. Considering the varying degrees of GenAI integration by the participants during the DMC production process, it remains unclear how GenAI use may contribute to DMC quality. Jiang and Li (2025), investigating GenAI influence on DMC quality by comparing the GenAI-assisted group and the traditional one, found a significantly higher overall quality produced by the former, although, dimension-wise, the results were mixed (Hafner & Ho, 2026; Li & Pham, 2025; Lin et al., 2025). This underscores the potential for continuous use of GenAI to foster DMC product quality despite the selective benefits it offers, recommending its integration into the DMC production process.

GenAI integration across DMC production process stages

The findings reveal how GenAI was integrated into DMC production process, performed in multiple stages. The initial stages by Hafner and Ho (2020) were found insufficient to accommodate all the stages that emerged during the GenAI integration, so adaptations were made. One essential adaptation includes breaking down the initial three stages into seven emerging stages: *idea generating, outlining, drafting, referencing, editing & proofreading, designing*, and *revising & reflecting,* and two revisiting stages: *re-referencing* and *re-idea generating stages.*

The process phase displays how GenAI integration may shape the patterns of the DMC production process. Rather than having a linear process, participants integrated GenAI in several, if not all, stages, and some had to go back and forth among stages to gain the most benefits of the tool. Hence, it creates a dynamic, iterative process that is uniquely different among the participants, confirming previous process-product research findings (Jiang & Lai, 2025; Smith et al., 2025). These unique process paths could be influenced by several factors, among which are the course and task design, learner characteristics, composing practices, and students' AI competency (Choi et al., 2026; Hafner & Ho, 2026; Jiang & Lai, 2025; Li & Pham, 2025), which are beyond the coverage of the current study. Hence, further studies are needed to investigate whether any of these factors might contribute to the iterative patterns of GenAI integration in DMC.

During interviews, the participants admitted facing challenges in using GenAI, one of which was generating expected modes and integrating the diverse modes into a good-quality DMC product (Hwang et al., 2025; Lin et al., 2025) at the *designing* stage. As reflected in the findings, learners found it difficult to generate expected outcomes from GenAI and had to re-prompt several times before being satisfied with the generated product. Interestingly, several participants decided to stop re-prompting and switch to readily available non-AI digital design tools like *Canva* or visual search engines like *Pinterest* for designing and image searching instead of exploring potential affordances of GenAI for designing purposes, which they claimed to be "a waste of time" (Yang & Markauskaite, 2025). This prompting skill issue is common, particularly among beginner GenAI users (Hafner & Ho, 2026), and has been considered one of the prominent skills in AI literacy (Knoth et al., 2024), requiring language educators and future educators to sharpen this particular skill for a successful integration. Warschauer and Xu (2024)

underscore the role of high English language proficiency as a prerequisite for prompting, leading to successful GenAI use.

A similar issue regarding GenAI use discontinuance is also found in other stages. At the *referencing* stage, for instance, several participants decided to quit searching for references from GenAI as hallucinations emerged and switched to non-AI platforms such as *Google Scholar* and *ResearchGate.* However, unlike the previous discontinuance that could stem from limited prompting skills, affective and cognitive factors presenting feelings and beliefs seem to play an essential role in the case. The participants' skeptical belief in GenAI use was apparently confirmed as they found unreliable outputs in the generated references to support the linguistic mode and images for the visual mode. A diverse array of feelings may emerge when using GenAI, ranging from excitement to anger, leading to skepticism, distrust, and eventually discontinuance (Hafner & Ho, 2026; Smith et al., 2025; Zhou & Zhang, 2025). Zhou and Zhang (2025), however, argue that this withdrawal is merely temporary, and they may go back to the technology as they gain increased trust and confidence in using GenAI.

Likewise, ethical fears regarding plagiarism and academic integrity violations, as presented in the ethical use of GenAI guideline, may inhibit users from engaging with GenAI (Hwang et al., 2025; Perkins, 2023). These concerns, however, guided the participants in using GenAI cautiously by critically analyzing the generated outputs in stages like *(re-)idea generating, outlining, (re-)referencing,* and *designing* and guardedly modifying the outputs to suit their needs and the essence of the DMC products designed without any ethical disruption. These cautious attempts have shaped a stronger student agency, *evolving agency*, in which the users were in charge of "when to use, or stop using, GenAI" (Yang & Markauskaite, 2025, p. 8). This integration also underlines how GenAI use could foster students' critical thinking skills and agency in addition to assisting students in their learning (Fan et al., 2025; Salido et al., 2025; Yang & Markauskaite, 2025; Zhao et al., 2025).

In addition to *evolving agency,* the participants performed two other agencies: *embryonic and emerging*, reflected in their engagement with GenAI. In *embryonic,* the participants evaluated mismatches between expectations and the generated products and then revised the prompts for better product quality, as performed by Aza and Roz. Aza's agency developed into *emerging* agency as he attempted to learn how to produce good prompts for generating images on *Instagram* to assist him with the prompting skill for improved product quality. These gradual learner agencies illustrate how learner agency could also be shaped from GenAI engagement during DMC production (Yang & Markauskaite, 2025).

Several GenAI constraints faced by the participants were also rooted in the free access to GenAI tools. The qualitative data reveal the participants' limited access to premium GenAI and AI accounts, hindering opportunities for obtaining optimum GenAI assistance. The premium accounts contain additional AI-powered features and advanced functionalities, which, combined with sound AI competency, could be potentially beneficial to enhance DMC product quality. Of all the participants involved, only one used the 'illegal' premium version, which she bought through the non-official vendor due to the high cost. This circumstance, and other technical issues, may illustrate the digital divide faced by language teachers and students with limited resources (Wang, 2025) in Indonesia, representing the

Global South, and thus creating more challenges for its integration (Idris & Amalia, 2025).

Implications and recommendations

This current study contributes a contextualized understanding and insights into both GenAI-enhanced DMC product quality and its production process across courses, reflecting L2 students' authentic GenAI use under limited instructional interventions. Several limitations, however, should be considered when interpreting the findings. First, the obtained results were derived from qualitative interpretations and may not reflect quantitative variance or causal links, so the descriptive interpretations should be approached with caution, and broad generalizations should be avoided. Future research may integrate qualitative and quantitative approaches to provide a more comprehensive basis for product quality comparison across courses. Next, the study is limited to language pedagogical contexts with a limited number of DMC products and participants in one university in Indonesia, whose results may not portray the overall Indonesian higher education contexts with diverse demographics. Hence, their applicability to other settings requires careful consideration. Limitations could also be found in the high-quality DMC products selected for interviews with the designers. While this selection was made with the perceived justification that high-quality DMC products may incorporate extensive GenAI integration, as reflected in Jiang and Lai (2025), this selection may not depict other potential learners whose extensive GenAI use does not result in high DMC quality. Future studies could include DMC designers across product quality levels to document their GenAI use and composing practices.

Theoretically, this study contributes to the growing field of study on GenAI integration in DMC, particularly on the product-process approach and how it presents qualitative interpretations on the connection between composing processes and product quality under minimum interference. This study also assists in understanding how GenAI affordances could only achieve optimal results under particular settings, learners' characteristics, and composing practices. Hence, designing a similar study with a particular setting, supported by learners' AI competency, may optimize the affordances of GenAI in DMC production. Furthermore, this study also offers insights into how GenAI integration during DMC production may shape learner agency, which remains underexplored despite its pedagogical significance in GenAI-induced settings.

The findings also bring pedagogical implications, providing insights into how GenAI integration during production qualitatively reflects learners' current stage of AI competency and agency. Hence, further pedagogical interventions are needed to strengthen learners' AI competency and support effective and ethical integration while sustaining their agency, for instance, by developing more targeted intervention programs focusing on specific areas of underdeveloped AI literacy and competency dimensions. Learners' AI competency, qualitatively depicted in the study, also highlights the digital divide that may continuously hinder effective AI integration unless urgent measures are taken, for instance, by providing intensive AI competency training and designing free-access GenAI tools for educational purposes and/or providing access to premium accounts limited to educational use. Next, applying Hafner and Ho's (2020) one-size-fits-all rubric on diverse forms of DMC products may not be sufficient to capture other dimensions that could be

uniquely found in particular DMC products. Hence, selecting and adjusting rubrics subject to the DMC product type could be considered to yield more reliable assessment of product quality.

Conclusion

This research presents an authentic exploration of GenAI integration among L2 students across three distinct courses under minimal teacher intervention. The research findings reveal the overall high-to-moderate quality, but with relatively low quality in the multimedia and visual effects, compared to the language and content-organization dimensions. Furthermore, the dynamic, non-linear process of GenAI interactions indicates the unique GenAI integration among students across courses. However, the findings are inconclusive since they did not include any continuous observations on the actual use of GenAI and involved few participants, which future researchers could take into account for further research in the area. Despite the research contributions on the role of GenAI in qualitatively portraying students' AI competency and agency, some questions regarding the measurement of their AI competency and the role of teachers in shaping the skills have not been answered yet, which thus requires a deeper exploration of these aspects.

References

Abdelhalim, S. M., & Alsehibany, R. (2025). Integrating ChatGPT for vocabulary learning and retention: A classroom-based study of Saudi EFL learners. *Language Learning & Technology, 29*(1), 1-24. https://doi.org/10.64152/10125/73635

Choi, H., Liu, Y., & Kim, Y. (2026). Writing quality, vocabulary learning, and reading comprehension in integrated reading-to-write tasks: A comparison of digital multimodal composing and traditional monomodal writing. *Studies in Second Language Learning and Teaching*, *16*(3), 601-630. https://doi.org/10.14746/ssllt.53401

Colorafi, K. J., & Evans, B. (2016). Qualitative descriptive methods in health science research. *HERD: Health Environments Research & Design Journal*, *9*(4), 16–25. https://doi.org/10.1177/1937586715614171

Cotelli Kureth, S., Paliot, E., & Zink, S. (2025). Fostering transparency: A critical introduction of generative AI in students' assignments. *Language Learning in Higher Education*, *15*(1), 6–85. https://doi.org/10.1515/cercles-2024-0105

Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE.

Fan, Y., Tang, L., Le, H., Shen, K., Tan, S., Zhao, Y., Shen, Y., Li, X., & Gašević, D. (2025). Beware of metacognitive laziness: Effects of generative artificial intelligence on learning motivation, processes, and performance. *British Journal of Educational Technology, 56*, 489–530. https://doi.org/10.1111/bjet.13544

Grammarly. (2026). Introducing generative AI assistance. *Grammarly*. https://support.grammarly.com/hc/en-us/articles/14528857014285-Introducing-generative-AI-assistance

Hafner, C. A. (2014). Embedding digital literacies in English language teaching: Students' digital video projects as multimodal ensembles. *TESOL Quarterly*, *48*(4), 655–685. https://doi.org/10.1002/tesq.138

Hafner, C. A., & Ho, W. Y. J. (2020). Assessing digital multimodal composing in second language writing: Towards a process-based model. *Journal of Second Language Writing*, *47*, Article 100710. https://doi.org/10.1016/j.jslw.2020.100710

Hafner, C. A., & Ho, W. Y. J. (2026). Doing digital multimodal composing with generative artificial intelligence: Towards an integrated critical digital literacies model. *Language Teaching Research*. https://doi.org/10.1177/13621688261459662

Hwang, Y., Shin, D., & Lee, J. H. (2025). Who owns AI-generated artwork? Revisiting the work of generative AI based on human-AI co-creation. *Telematics and Informatics*, *98*, Article 102266. https://doi.org/10.1016/j.tele.2025.102266

Idris, I. K., & Amalia, N. (2025, May 31). *AI curriculum amid digital divide in Indonesia*. The Jakarta Post https://www.thejakartapost.com/opinion/2025/05/31/ai-curriculum-amid-digital-divide-in-indonesia.html.

Jiang, J. (2024). When generative artificial intelligence meets multimodal composition: Rethinking the composition process through an AI-assisted design project. *Computers and Composition*, *74*, Article 102883. https://doi.org/10.1016/j.compcom.2024.102883

Jiang, L., & Lai, C. (2025). How did the generative artificial intelligence-assisted digital multimodal composing process facilitate the production of quality digital multimodal compositions: Toward a process-genre integrated model. *TESOL Quarterly*, *59*(S1), S52–S85. https://doi.org/10.1002/tesq.3390

Jiang, L., Li, Z., & Leung, J. S. C. (2024). Digital multimodal composing as translanguaging assessment in CLIL classrooms. *Learning and Instruction*, *92*, Article 101900. https://doi.org/10.1016/j.learninstruc.2024.101900

Jiang, L., & Luk, J. (2016). Multimodal composing as a learning activity in English classrooms: Inquiring into the sources of its motivational capacity. *System*, *59*, 1–11. https://doi.org/10.1016/j.system.2016.04.001

Jones, R. H., & Hafner, C. A. (2021). *Understanding digital literacies: A practical introduction* (2nd ed.). Routledge. https://doi.org/10.4324/9781003177647

Kessler, M. (2022). Multimodality. *ELT Journal*, *76*(4), 551-554. https://doi.org/10.1093/elt/ccac028

Kim, J., Yu, S., Detrick, R., & Li, N. (2025). Exploring students' perspectives on Generative AI-assisted academic writing. *Education and Information Technologies*, *30*, 1265–1300. https://doi.org/10.1007/s10639-024-12878-7

Knoth, N., Tolzin, A., Janson, A., & Leimeister, J. M. (2024). AI literacy and its implications for prompt engineering strategies. *Computers and Education: Artificial Intelligence*, *6*, Article 100225. https://doi.org/10.1016/j.caeai.2024.100225

Kostopolus, E. (2025). Student use of generative AI as a composing process supplement: Concerns for intellectual property and academic honesty. *Computers and Composition*, *75*, Article 102894. https://doi.org/10.1016/j.compcom.2024.102894

Li, D., Xia, S., & Guo, K. (2025). Investigating L2 learners' text-to-video resemiotisation in AI-enhanced digital multimodal composing. *Computer Assisted Language Learning, 39*(5-6), 1554-1585. https://doi.org/10.1080/09588221.2025.2481402

Li, M., & Pham, Q. N. (2025). Three heads are better than one? Digital multimodal composition completed collaboratively versus individually. *Language Teaching Research*, *29*(5), 1866–1888. https://doi.org/10.1177/13621688221102536

Lim, F. V. (2026). Designing literacy learning with multimodality in the age of generative AI. *LLT Journal: A Journal on Language and Language Teaching*, *29*(1), 1–17. https://doi.org/10.24071/llt.v29i1.694

Lin, C.-H., Zhou, K., Li, L., & Sun, L. (2025). Integrating generative AI into digital multimodal composition: A study of multicultural second-language classrooms. *Computers and Composition*, *75*, Article 102895. https://doi.org/10.1016/j.compcom.2024.102895

Moorhouse, B. L., Hafner, C. A., & Ho, T. Y. (2026). GenAI-assisted digital multimodal composing in TESOL teacher education. *TESOL Quarterly*. https://doi.org/10.1002/tesq.70184

Moorhouse, B. L., Wan, Y., Wu, C., Kohnke, L., Ho, T. Y., & Kwong, T. (2024). Developing language teachers' professional generative AI competence: An intervention study in an initial language teacher education course. *System*, *125*, Article 103399. https://doi.org/10.1016/j.system.2024.103399

Perkins, M. (2023). Academic integrity considerations of AI large language models in the post-pandemic era: ChatGPT and beyond. *Journal of University Teaching and Learning Practice*, *20*(2), 1-24. https://doi.org/10.53761/1.20.02.07

Pham, Q. N., & Li, M. (2023). Digital multimodal composing using Visme: EFL students' perspectives. *The Asia-Pacific Education Researcher*, *32*, 695–706. https://doi.org/10.1007/s40299-022-00687-w

Salido, A., Syarif, I., Sitepu, M. S., Suparjan, Wana, P. R., Taufika, R., & Melisa, R. (2025). Integrating critical thinking and artificial intelligence in higher education: A bibliometric and systematic review of skills and strategies. *Social Sciences & Humanities Open*, *12*, Article 101924. https://doi.org/10.1016/j.ssaho.2025.101924

Smith, B. E., Amgott, N., & Malova, I. (2022). "It made me think in a different way": bilingual students' perspectives on multimodal composing in the English language arts classroom. *TESOL Quarterly*, *56*(2), 525-551. https://doi.org/10.1002/tesq.3064

Smith, B. E., Shimizu, A. Y., Burriss, S. K., Hundley, M., & Pendergrass, E. (2025). Multimodal composing with generative AI: Examining preservice teachers' processes and perspectives. *Computers and Composition*, *75*, Article 102896. https://doi.org/10.1016/j.compcom.2024.102896

Söğüt, S., & Hegelheimer, V. (2026). Developing learner agency through human-GenAI interaction in digital multimodal composing. *TESOL Journal*, *17*(2), Article e70116. https://doi.org/10.1002/tesj.70116

Sok, S., & Shin, H. W. (2025). Do interactions with ChatGPT influence L2 learners' oral speaking ability, summarization ability, and perceptions of Generative AI tasks? *TESOL Quarterly*, *59*(S1), S19-S51. https://doi.org/10.1002/tesq.70001

Song, X., Razali, A. B., Sulaiman, T., & Jeyaraj, J. J. (2024). Impact of project-based learning on critical thinking skills and language skills in EFL context: A review of literature. *World Journal of English Language*, *14*(5), 402-412. https://doi.org/10.5430/wjel.v14n5p402

Stell, A. (2025). Exploring multimodality in technology-mediated collaborative writing: An activity theory. *Language Learning & Technology*, *29*(3), 182-204. https://doi.org/10.64152/10125/73652

Stenalt, M. H. (2021). Digital student agency: Approaching agency in digital contexts from a critical perspective. *Frontline Learning Research*, *9*(3), 52-68. https://doi.org/10.14786/flr.v9i3.697

Su, Y., Lin, Y., & Lai, C. (2023). Collaborating with ChatGPT in argumentative writing classrooms. *Assessing Writing*, *57*, Article 100752. https://doi.org/10.1016/j.asw.2023.100752

Talakoob, F., Tabrizi, H. H., & Shafiee, S. (2025). Digital multimodal composing vs. MOOC-based instruction: Effects on IELTS candidates' speaking fluency and coherence. *Turkish Online Journal of Distance Education*, *26*(4), 222-239. https://doi.org/10.17718/tojde.1609742

Wang, D. (2025). Mind the gap in AI integration: A comparative study of language teachers' responses in a national survey. *Language, Culture and Curriculum*, 1–18. https://doi.org/10.1080/07908318.2025.2574633

Wang, H. (2022). International English learners' perspectives on multimodal composing and identity representation via multimodal texts. *Sage Open*, *12*(2), 1-15. https://doi.org/10.1177/21582440221103526

Warschauer, M., & Xu, Y. (2024). Artificial intelligence for language learning: Entering a new era. *Language Learning & Technology*, *28*(2), 1–4. https://doi.org/10.64152/10125/73569

Wu, D., & Zhang, J. (2025). Generative artificial intelligence in secondary education: Applications and effects on students' innovation skills and digital literacy. *PLOS One*, *20*(5), 1–22. https://doi.org/10.1371/journal.pone.0323349

Xia, S. (2024). Incorporating digital multimodal composition in content teaching: A multimodal analysis of students' legal popularization videos. *Journal of Second Language Writing*, *66*, Article 101163 https://doi.org/10.1016/j.jslw.2024.101163

Xia, S., & Li, Z. (2026). Can digital multimodal composition facilitate content learning in a CLIL context? Insights from students' composing processes in a legal English course. *English for Specific Purposes*, *81*, 73–91. https://doi.org/10.1016/j.esp.2025.09.003

Xie, L., & Jiang, L. (2025). Promoting second language writing autonomy through digital multimodal composing. *Journal of Second Language Writing*, *69*, Article 101225. https://doi.org/10.1016/j.jslw.2025.101225

Yang, H., & Markauskaite, L. (2025). Fostering language student teachers' transformative agency for embracing GenAI: A formative intervention. *Teaching and Teacher Education*, *159*, Article 104980. https://doi.org/10.1016/j.tate.2025.104980

Yu, S., Zhang, E. D., & Liu, C. (2026). Research into practice: Digital multimodal composition in second language writing. *Language Teaching*, *59*(2), 197–213. https://doi.org/10.1017/S0261444824000375

Zhai, C., Wibowo, S., & Li, L. D. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: A systematic review. *Smart Learning Environments*, *11*, Article 28. http://doi.org/10.1186/s40561-024-00316-7

Zhang, E. D., & Yu, S. (2024). Understanding L2 student writers' self-assessment in digital multimodal composing: A process-oriented approach. *System*, *121*, Article 103219. http://doi.org/10.1016/j.system.2024.103219

Zhao, G., Sheng, H., Wang, Y., Cai, X., & Long, T. (2025). Generative artificial intelligence amplifies the role of critical thinking skills and reduces reliance on prior knowledge while promoting in-depth learning. *Education Sciences*, *15*(5), Article 554. https://doi.org/10.3390/educsci15050554

Zhou, T., & Zhang, C. (2025). Examining generative AI user intermittent discontinuance from a C-A-C perspective. *International Journal of Human–Computer Interaction*, *41*(10), 6377–6387. https://doi.org/10.1080/10447318.2024.2376370

Zhussupova, R., & Shadiev, R. (2023). Digital storytelling to facilitate academic public speaking skills: Case study in culturally diverse multilingual classroom. *Journal of Computers in Education*, *10*, 499–526. https://doi.org/10.1007/s40692-023-00259-x