Perceptions of AI-facilitated creativity in language education: A study on digital storytelling

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The study investigates perceptions of AI-facilitated creativity in English as a Foreign Language (EFL) digital storytelling (DST). Focusing on language learners, instructors, and audience, the research explores how AI influences creative processes and how such creativity is perceived across different perspectives. Over a six-week period, 32 EFL students used AI tools to create digital stories. The study employed pre- and post-intervention surveys to assess students' perceptions of AI-enhanced creativity, while the resulting digital stories were evaluated by instructors as experts, and peers as audiences to gather multi-perspective insights. Findings reveal that while AI tools significantly enhanced visual and audio elements, aiding in the contextualization of stories, the creative essence, particularly in narrative development, was consistently preferred when human input played a central role. The study uncovered favorable attitudes towards AI-facilitated learning, with noticeable improvements in post-intervention surveys. However, despite these technical enhancements, human-created storylines were valued more highly by the audience than AI-generated components. The results suggest that while AI can augment certain aspects of digital storytelling, such as enhancing multimedia elements, it does not replace the core creative input provided by humans. This has implications for the integration of AI in educational settings, particularly in language learning and creative disciplines. The study advocates for a balanced approach where AI supports, but does not substitute, human creativity.

Keywords: creativity, artificial intelligence generative content (AIGC), digital storytelling (DST), English as a foreign language (EFL)

1. Introduction

Technological advancements, particularly in generative AI, challenge the idea that creativity is solely human, reframing roles in content creation (De Cremer et al., 2023). Generative models like ChatGPT can produce varied content, stirring debate on AI's impact on creativity. Some regard AI as a collaborative partner in the creative process, facilitating idea generation (Lomas, 2023) and enriching the combination of ideas (Eapen et al., 2023). Conversely, some contend that AI cannot replicate the depth of human cultural understanding and the capacity for creative leaps (De Cremer et al., 2023). A neutral perspective posits that AI's effectiveness in education depends on its application (Resnik, 2023). The question of whether generative AI augments or undermines creativity is still open for further inquiry.

Technology has opened new paths for enhancing creativity and communicative competence in language education. Digital storytelling (DST) in English as a foreign language (EFL) teaching stands out, offering substantial benefits in language development and creative skills (Wu & Chen, 2020). Different from traditional storytelling, which relies on linear narrative and oral or written forms, DST incorporates multimedia elements that allow for a dynamic expressions and interactive experience. This approach facilitates not just language learning but also creative output (Robin, 2008). The advent of generative AI further expands DST's potential, with tools like ChatGPT and Midjourney supporting learners in creating more sophisticated digital narratives (Cao et al., 2023). With generative AI's significant advancements in 2023, the potential for AIGC in language teaching prompts a closer examination of learners' perceptions and attitudes towards the learning experience, particularly regarding the display of creativity facilitated by AI.

This study investigates how EFL learners perceive AI-facilitated creativity, using DST as a medium to exhibit such innovation. It emphasizes the role of technology in language pedagogy and creative education while examining the effects of AIGC on learners' creative displays within DST. This research aims to answer the following questions:

1. What are the perceptions and attitudes of EFL learners towards AI-facilitated digital storytelling, specifically in terms of creative thinking, knowledge expansion, technology acceptance, and social interaction?
2. In what ways does artificial intelligence contribute to the expression of creativity in digital storytelling, and how does this influence viewer engagement?

2. Literature review

2.1. Defining creativity and its significance in education

In the era of globalization and digitalization, creativity and critical thinking have gained even greater importance, especially in higher education (Runco, 2014; Vincent-Lancrin et al., 2019). Creativity is defined by the integration of critical thinking, flexibility, organization, imagination, and the ability to

generate novel solutions (Amabile, 2017; Runco, 2014). Recognizing the growing importance of creativity, teachers, curriculum designers, and educational policymakers must embrace its critical role and explore innovative approaches to foster creativity in education (Noddings, 2013).

Creativity was first researched and defined in the field of psychology since 1950. It is regarded as a cognitive construct (Simonton, 2012), defined as the ability to generate novel ideas, logical solutions, and rationalized plans in response to specific problems (Guilford, 1959). Two cognitive skills associated with creativity are divergent thinking and convergent thinking: Divergent thinking is a cognitive process that involves generating a wide variety of possible solutions or ideas in response to an open-ended question or problem. Four facets were identified: fluency, which refers to the capacity to generate numerous ideas; flexibility, representing the ability to produce ideas covering a wide range of different concepts; originality, denoting the ability to generate unconventional and unique ideas; and elaboration, indicating the extent to which ideas are detailed or developed (Guilford, 1959). Conversely, convergent thinking is a cognitive process that involves the ability to find a single, correct solution to a well-defined problem; it is characterized by its focus on specific goals, reliance on logical reasoning and deduction to find the best solution, and emphasis on achieving correctness or accuracy in the outcome (Guilford, 1959). While past research has predominantly focused on divergent thinking due to its significant role in idea generation, an emphasis arises from the understanding that creative output necessitates not only idea generation but also the ability to make informed decisions in selecting the best solutions (Harvey, 2013). It is suggested to assess both divergent and convergent thinking aspects of creativity (Suzuki et al., 2022).

Definitions of creativity display degree of specificity across disciplines (Marquis & Vajoczki, 2012). Scientific creativity entails the ability to conduct innovative experiments, address challenging scientific issues, and partake in inventive science-related endeavors (Raj & Saxena, 2021). Similarly, creativity in the field of economics and management is closely intertwined with innovation, characterized as the generation of novel and fitting ideas, processes, products, or services to address clients' identified problems or opportunities (Linxweiler, 2016). In the field of education, creative thinking skills are defined as a cognitive process that fosters increased problem sensitivity, identification of knowledge gaps, problem-solving, hypothesis formation, and the development of fresh solutions (Greenstein, 2012). Though with minor differences, the definitions and realization of creativity in different disciplines demonstrate noteworthy similarities in their emphasis on innovation, problem-solving, and the generation of novel ideas.

Various factors are found to influence creativity, including characteristics, attitudes, motivations, and environments. While talent is commonly perceived as a fundamental impact on individual creativity, ample evidence suggests that hard work and intrinsic motivation, both influenced by the social environment, also hold pivotal roles (Amabile, 2001). According to the "Intrinsic Motivation Principle of Creativity" proposed by Amabile (2017), individuals are

most likely to unleash their creativity when they are primarily motivated by inherent interest, enjoyment, satisfaction, and the challenge found within the work itself, rather than external pressures. Moreover, empirical research has verified that creativity can be nurtured through various teaching techniques or trainings (Ritter & Mostert, 2017; Raj & Saxena, 2021). These findings emphasize the multifaceted nature of factors that contribute to the development and expression of creativity.

In second language acquisition research, creativity is seen as an essential characteristic of learners, positively influencing language learning through aspects like openness and challenge engagement (Dewaele, 2012; Verhoeven & Vermeer, 2002). Studies show a correlation between creativity and pragmatic competence (Verhoeven & Vermeer, 2002), and a link between openness to experience and intrinsic motivation (Tan et al., 2016). The role of creativity extends to vocabulary learning, with positive impacts on semantic fluency and the quality of verbal expression in L2 learners (Fernández-Fontecha, 2021), as well as on speech production, enhancing cohesion and information delivery (Suzuki et al., 2022). Despite these benefits, the inclusion of creativity in teaching strategies remains underutilized (Dörnyei & Ryan, 2015), suggesting a need for more imaginative and problem-solving instructional approaches in language teaching.

2.2. Encouraging creativity through digital narratives

Storytelling has gained significant interest in L2 teaching as it is believed to inspire creativity, cultivate critical thinking, spark imagination, and even promote moral reasoning (Wu & Chen, 2020). Technological advancements have further enriched traditional storytelling by integrating informational communicative technology. One such powerful approach is digital storytelling (DST), a form of digital narrative considered highly effective for technology-enhanced learning and constructivist instruction (Lambert, 2013). Digital storytelling is a modern way of telling stories that uses computers and multimedia tools to revive the ancient art of written or oral storytelling. By incorporating technology-integrated, project-based, and student-centered learning experiences, DST proves to be a successful facilitator of modern educational practices (Robin, 2016; Wu & Chen, 2020).

Digital storytelling possesses potential to enhance various facets of EFL students' communicative competence. Harji and Gheitanchian (2017) conducted a study with 57 EFL students who engaged in a 16-week digital storytelling project, resulting in significant improvements in their oral language outputs. The participants demonstrated enhanced accuracy, fluency, and sophistication in their language usage. Similarly, Yang, Chen, and Huang (2020) had 54 seventh-grade EFL learners engaged in a DST project over eight weeks. The project proved effective in enhancing the students' speaking proficiency and creative thinking. In addition to oral skills, written communication has also shown positive outcomes. Al-Amri (2020) worked with 32 EFL learners who collaboratively created five digital stories over 12 weeks. The study emphasized the positive impact of digital storytelling on lexical competence, as evidenced

by the participants' written scripts, showcasing their adeptness in incorporating newly acquired words into their narratives. These studies and findings support the efficacy of digital storytelling in fostering the language abilities of EFL students.

Digital storytelling (DST) not only facilitates language learning but also fosters creativity by allowing for multimodal expressions in narrative construction. Burmark (2004) introduced digital storytelling as a sophisticated technology for gathering, creating, examining, and merging visual images with textual content. He emphasized that the integration of visual elements with written texts not only amplifies comprehension but also fosters learners' curiosity and interest in exploring innovative concepts. Robin (2008) also contended that DST possesses the potential to captivate students, not solely in terms of course material engagement, but also in stimulating creativity. The incorporation of multimedia elements in a digital story can effectively serve as an anticipatory set or hook, captivating students' attention and intensifying their curiosity, thereby cultivating a strong desire to explore and embrace novel ideas. Yang et al. (2020) attributed the enhanced creativity to output-driven learning experiences that integrated multiple literacies, allowing students to craft digital stories as meaningful multimodal elements. Hence, DST emerges as a formidable tool that encourages both active learning and creative expression in educational settings.

In sum, DST holds promise in the field of EFL teaching, offering multifaceted benefits for language and communicative competence enhancement, as well as fostering creativity among learners. However, it is worth noting that the potential of using DST specifically for creativity education in the context of EFL teaching remains unexplored. Further research should be conducted to illuminate the full extent of DST's impact on creativity development and language education.

2.3. AIGC in digital narratives

Artificial intelligence generated content (AIGC) is a cutting-edge technology that uses artificial intelligence (AI) to automatically create personalized content, such as images, text, and videos, according to user preferences (Wu et al., 2023). The development of AIGC is marked by three key stages: early achievements in AI using primitive programming, further progress driven by enhanced databases and computing equipment, and rapid advancements featuring innovations like the Generic Adversarial Network. Generative AI, such as ChatGPT, involves training machines to recognize patterns, analyze data, and generate novel content that closely resembles human creations. Employing advanced techniques such as deep learning, neural networks, and probabilistic models, generative AI algorithms comprehend the underlying structures of datasets and create unique outputs (NexMutation Technology, 2023).

One significant application of AIGC is its potential to improve digital storytelling. By extracting and understanding intent information from human instructions, AIGC may generate content that aligns with the desired narrative

and creative vision. As the field advances, large-scale models may enhance intent extraction and thus improving the quality of generated content. This progress enables AIGC to produce more realistic and high-quality storytelling experiences, making content creation more efficient and accessible (Cao et al., 2023) For instance, ChatGPT, introduced by OpenAI in 2022, leverages natural language processing (NLP) to respond to user questions. It may empower writers and storytellers to focus on creativity while handling routine tasks like generating filler text (Cranfield, Venter, & Daniels, 2023). Moreover, text-to-image generative AI, including Stable Diffusion, complements narratives with visually realistic images, transforming digital storytelling. Additionally, text-to-video generative AI, such as Runway, combines text-to-image and video generation, incorporating advanced audio-visual effects (Zhang et al., 2015).

These AI-driven technologies hold the potential to expand the creative horizons of DST. However, there remains an area of exploration concerning how learners may integrate innovative tools into their story composition process. The present study aims to investigate the effects of AIGC on EFL learners' creative displays within DST.

3. Methodology

3.1. Participants and research site

The study involved thirty-two English majors from a private university in northern Taiwan, including fifteen juniors and seventeen seniors. Of these participants, nineteen were female and thirteen were male, all native Mandarin Chinese speakers with an average English learning experience of ten years. Their English proficiency ranged from intermediate to high intermediate, based on simulated TOEIC test scores. The participants, with an average age of 21, are part of Generation Z – neo-digital natives known for their adeptness with portable digital devices and information technology (Generation Z, 2023). This background suggests a predisposition for adapting to digital tools in learning, which is essential in exploring the interface between AI-facilitated creativity and language education.

The study took place during the Spring semester of 2023 within the context of an elective course titled "English of Cultural and Creative Industries," consisting of 2-hour classes over 18 weeks. The study aligned with the course's objective of fostering creativity and integrating technology. The instructor, with over fifteen years of teaching experience and expertise on technology-enhanced language learning, was capable of applying generative AI in class. Students were informed about the study at the semester's outset, and consent was obtained later when the study commenced; only the work of consenting students was analyzed, while all students received equal support throughout the course. All students provided their consent.

3.2. Materials

Creative producer project. Participants were asked to create a "Creative Producers" project – a six-week assignment to craft an imaginative digital narrative showcasing their creativity. Students were encouraged to utilize generative AI tools for script creation and audiovisual production. The final product, either a video or illustrated book, was constrained to a 5–8-minute duration, ensuring a focused narrative scope. It included a narrator's voice, background music, captions, and visuals. The script must showcase creativity, engaging characters, and a compelling plot in any genre. The students' ability to enhance the script and audiovisuals using AI tools, while maintaining language proficiency and ensuring an enjoyable viewing experience, would be central to their success.

To foster an environment that nurtures creativity, the project was designed with a strong emphasis on flexibility and freedom. Students were granted the autonomy to select team size: they could work independently, in pairs, or in groups ranging from three to four individuals. While English was the main language used for the script, students enjoyed the creative liberty to integrate and code-mix other languages as needed. Furthermore, the project promoted the utilization of AI tools, empowering students to harness technology as a powerful catalyst for unleashing their creative potential.

Generative AI tools. The project equipped students with a diverse array of generative AI tools, crucial for crafting comprehensive digital narratives that encompassed videos, narrations, audio, and images. The selection of AI tools was based on specific criteria, ensuring they were available for free or with limited free usage, easily accessible through account creation, usable online without the need for installation. The utmost priority was given to their generative AI functions, such as giving instructions and responding to commands, facilitating an interactive and engaging creative process. Table 1 lists the introduced AI tools categorized according to their respective functions:

Table 1. Generative AI tools introduced in class

Function	AI tools
Script	ChatGPT, Chat Everywhere, Bing
Video	Clipchamp, CapCut, Runway
Narration	D-ID, AI Voiceover, Rask.ai
Music	Shutterstock AI Music, Mubert Render, Songr.AI
Images	Dall.E.2, Being Image Creator, Stable Diffusion, Shutterstock

It is worth noting that the study was conducted during the Spring semester of 2023, a period of early prosperity in the AI era. Consequently, the choices of AI tools were influenced by their availability at that time. These AI tools empowered students with the tools to elevate their creative narratives and enhance the overall quality of their projects. By leveraging these advanced

technologies, students were expected to bring a higher level of innovation and artistic expression to their digital narratives.

3.3. Instruments

Survey on technology-enhanced creativity (STEC). To explore the impact of technology on creative language learning, a tailored survey was developed to understand participants' attitudes. While the Torrance Tests of Creative Thinking (TTCT) are well-established for creativity assessment used in related research (e.g., Yang et al., 2020), they were not used in this study because they focus on innate creative talents such as fluency and originality (Torrance, 1998) and may have a domain-specific impact (Baer, 2016). This research, however, adopts a wider perspective of creativity, considering how technology, particularly AI, supports creative outputs. Thus, a questionnaire, based on relevant literature, was crafted to align with the study's objectives.

The literature review indicates that creativity is the generation of novel ideas and effective problem-solving (Simonton, 2012; Harvey, 2013). Hence, (1) creative thinking and problem-solving skills are crucial for generating unique ideas and tackling complex problems, as creative thinking facilitates problem recognition, knowledge gap identification, and the development of innovative solutions (Greenstein, 2012), making (2) knowledge expansion and learning efficiency vital for creative progress. The study also considers (3) technology literacy and acceptance, building on evidence that Digital Storytelling (DST) can boost creativity (Burmark, 2004; Robin, 2008), to see if AI interventions improve creative language use. Finally, (4) the significance of social interaction and collaboration is acknowledged for their role in enhancing motivation and creativity (Amabile, 2001; Amabile, 2017).

The intricate interplay among these four constructs underscores their significance within the expansive realm of creativity, emphasizing their foundation in innovation, problem-solving, and the generation of novel ideas across diverse contexts. The Survey on Technology-Enhanced Creativity (STEC) was developed. During its creation, a panel of experts knowledgeable about these constructs critically assessed the questionnaire items to ensure they effectively measure the intended areas and cover the domain of interest comprehensively. The content validity of the questionnaire was established.

The STEC employs a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Initially comprising thirty statements, constructs (1) and (3) had eight items each, and constructs (2) and (4) had seven each. The reliability of the instrument was measured using a 54-student sample from the same department as the target participants, with Cronbach's alpha utilized for reliability assessment. Table 2 below reports the results: the preliminary analysis yielded an overall Cronbach's alpha coefficient of $\alpha(30) = .95$, with the coefficients observed for the four constructs: $\alpha1(8) = .96$, $\alpha2(8) = .84$, $\alpha3(7) = .81$, $\alpha4(7) = .80$. To improve the reliability, five items with lower coefficients were removed. The refined questionnaire's overall alpha increased to $\alpha(25) = .98$, indicating higher internal consistency. The revised construct coefficients were $\alpha1(7) = .95$,

α2(6) = .93, α3(6) = .91, and α4(6) = .89, reflecting enhanced reliability across the board. The final 25-item version (Appendix A) served as the pretest and as the posttest, with the item reordered to reduce potential biases.

Table 2. Reliability analysis on the survey questionnaire

Construct	1st version (# = 30)		2nd version (# = 25)	
	Item number	Cronbach's Alpha	Item number	Cronbach's Alpha
(1) creative thinking, problem-solving, critical thinking	1,2,4,8,11,13,18,27 (# = 8)	.96	1,2,4,8,11,13,18 (# = 7)	.95
(2) knowledge expansion and learning efficiency	3,6,9,10,12,14,28,29 (#=8)	.84	3,6,9,10,12,14 (# = 6)	.93
(3) technology literacy and acceptance	15,16,17,22,23,25,30 (#=7)	.81	15,16,17,22,23,25 (#=6)	.91
(4) social interaction and collaboration	5,7,19, 20, 21,24,26 (# = 7)	.80	5,7,19,20,21,24 (# = 6)	.89

Evaluations of AI-facilitated creativity. To assess AI-facilitated creativity and to identify the advancements, three evaluation methods were implemented: peer, expert, and audience evaluation, contributing to a comprehensive understanding of creativity within the DST. Table 3 display the types and criteria for evaluation methods. Firstly, peer evaluation involved all 32 students in class. They evaluated their peers' works using a 5-point scale from 1 (poor) to 5 (excellent), based on predefined criteria: Creativity and originality, Effective use of AI tools, and Audiovisual quality. Secondly, expert evaluation, conducted by both a professional movie producer and the instructor, also applied the same criteria and evaluation system but placed a strong emphasis on offering professional insights during the assessment process.

Thirdly, audience evaluation involved 35 freshmen and sophomore students from the same department. To heighten interest and interaction, the audience engaged in an anonymous voting process rather than a formal evaluation system. They vote for projects in four categories, which aligned with the same criteria from expert and peer evaluations: AI Visionary Award (exceptional AI tool incorporation, i.e., Effective use of AI tools), Master of Storytelling Award (outstanding storytelling, i.e., Creativity and Originality), and AI-Driven Visual Effects Award (impressive AI tool effects, i.e., Audiovisual quality). An additional award, the Audience Choice Award, was established to allow audience to vote for their personal favorite, providing a wider perspective from the audience's viewpoint. The audience could cast one vote for each award. These awards contributed to a diverse and more comprehensive observation of creativity displayed within the DST.

Table 3. List of evaluation criteria and corresponding awards

Type of evaluation	Peers	Experts	Audience
Evaluation measure	5-point Likert scale; mean scores	5-point Likert scale; mean scores	1 vote for each award; vote counts
Criteria for evaluation	– Creativity and originality – Effective use of AI tools – Audiovisual quality	– Creativity and originality – Effective use of AI tools – Audiovisual quality	– Master of Storytelling Award – AI Visionary Award – AI-Driven Visual Effects Award – Audience Choice Award

3.4. Procedure

The six-week creative producer project was conducted during regular class time, and participating students were informed beforehand about the use of generative AI tools throughout the study. In Week 1, students were briefed on the project requirements, along with an overview of the AI tools they would use. Weeks 2 and 3 were dedicated to scriptwriting, with students being guided on effective idea development. In Weeks 4 and 5, students continued their work on scripts and audiovisual production, utilizing in-class time for group consultations and receiving peer feedback. During these four weeks, the instructor introduced the AI tools in class, demonstrated their usage, and provided students with opportunities for practice. At the conclusion of Week 6, students were expected to present their completed scripts and audiovisual files to the entire class. Alongside their presentations, students explained their creative process, presented their reports, and addressed any questions from their classmates, the instructor, and an invited expert as a professional movie producer. The peer evaluation and the expert evaluation were thus obtained. Figure 1 illustrates the procedure.
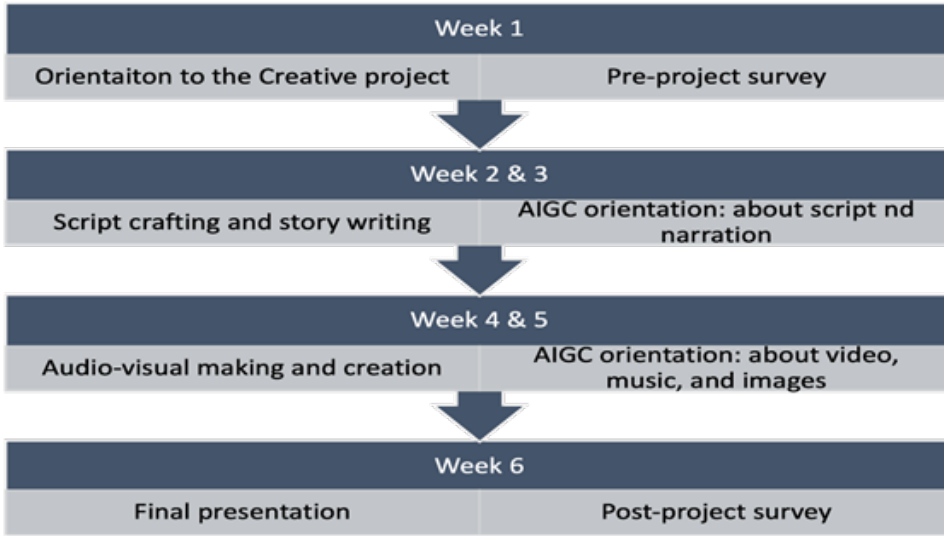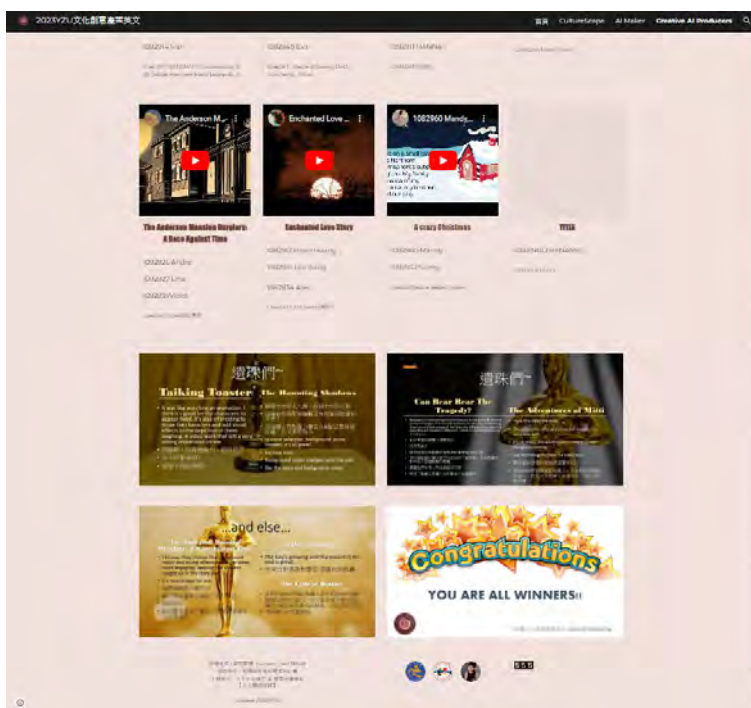
Figure 1. The procedure of the creative producer project

Students' digital narratives were uploaded to a dedicated project website and shared among the students in the department, serving as the audience, for easy access (see Figure 2). To enhance audience engagement, an online evaluation sheet was made available on the webpage; the audience was invited to view the videos and provide feedback during a one-week period. Evaluation results and comments were collected for further analysis.

Figure 2. The website of the creative producer project (Accessible through: https://sites.google.com/view/2023yzucci/ai-maker)

The STEC was administered in Week 1 as the pretest to measure the students' perceptions and attitudes toward the latest technology, particularly AI, at the project's outset. One week after the project concluded, the survey was conducted once again as a posttest, accompanied by some open-ended questions designed to capture the participating students' reflections.

4. Results and discussion

4.1. EFL learners' perceptions and attitudes toward AI-facilitated DST

The STEC was conducted as the pretest and the posttest to investigate the participant perceptions and attitudes toward the latest technology and its functions, and changes after experiencing AI-facilitated intervention. Table 4 reports the results of the survey in averages.

In the pretest, participants displayed a generally positive attitude towards the subject, with a mean score of 3.98 and a standard deviation of 0.73. However, after the teaching intervention, their attitudes showed an improvement, M = 4.38, SD = 0.59. To assess the significance of this change, a paired-sample t-test was conducted to compare the pretest and posttest scores. The analysis revealed a statistically significant increase, $t(31)$ = 3.16, $p < .001$, with a moderate effect size of .60.

These findings suggest that the teaching intervention had a positive impact

on participants' attitudes, resulting in significantly more positive perceptions of AI technology. The effect size indicates that the observed improvement is of practical significance, underscoring the importance of the teaching intervention in influencing participants' attitudes.

Table 4. Comparison of pretest and posttest

	N	*M*	*SD*	*t*	Sig. (2-tailed)	Cohen's *d*
Pretest	32	3.98	0.73	3.16	.00**	.60
Posttest	32	4.38	0.59			

Note. ** *p*<.01

4.2. EFL learners' perceptions and attitudes toward creativity development

Four constructs were adopted to define the participants' perceived creativity development, including creative thinking, knowledge expansion, technology acceptance, and social interaction. To assess the development, the mean scores of the test items for the four constructs in the pretest and the posttest respectively were calculated using paired-sample *t*-test method. Table 5 reports the results of comparisons.

In the initial phase of the study, participants demonstrated the most positive attitudes toward (4) social interaction and collaboration (*M* = 4.12, *SD* = 0.70), followed by (2) knowledge expansion and learning efficiency (*M* = 4.01, *SD* = 0.77), (1) creative thinking, problem-solving, critical thinking (*M* = 3.92, *SD* = 0.80), and (3) technology literacy and acceptance (*M* = 3.88, *SD* = 0.78). However, following the learning involving AI tools, their attitudes underwent a minor transformation, with the mean scores ranked from highest to lowest: (2) knowledge expansion and learning efficiency (*M* = 4.28, *SD* = 0.95), (4) social interaction and collaboration (*M* = 4.23, *SD* = 0.98), (1) creative thinking, problem-solving, critical thinking (*M* = 4.18, *SD* = 0.96), and finally (3) technology literacy and acceptance (*M* = 4.16, *SD* = 1.00).

The shift in the ranking of mean scores suggests a change in participants' attitudes. Initially, they valued AI's role in social interaction (Construct 4) most, but after the learning experience, knowledge expansion and learning efficiency (Construct 2) became the highest ranked. Although the changes in scores were not statistically significant, this shift reflects increased confidence in AI's potential for enhancing learning efficiency. Notably, technology literacy and acceptance (Construct 3) remained the lowest ranked, indicating participants' limited familiarity with AI despite being digital natives. This highlights the need for better orientation to AI tools.

Upon closer examination of the creativity development changes, it is observed that construct (1) exhibited the most increase in mean score; however, this change did not attain statistical significance, *t*(31) = 1.68, *p* > .05. Similarly, construct (2) displayed the second highest change, yet it remained statistically insignificant, *t*(31) = 1.64, *p* > .05. The remaining two constructs also failed to

reach a level of statistical significance: construct (3) yielded $t(31) = 1.47$, $p > .05$, and construct (4) $t(31) = 0.62$, $p > .05$. The finding may imply that the observed variations could have occurred due to chance or other factors. Further exploration is necessary to ascertain whether these observed changes would hold significance in a broader context.

Table 5. Comparison of pretest and posttest for four constructs of creativity

Construct		M	SD	t	Sig. (2-tailed)	Cohen's d
(1) Creative thinking, problem-solving, critical thinking	Pretest	3.92	0.80	1.68	.10	.29
	Posttest	4.18	0.96			
(2) Knowledge expansion and learning efficiency	Pretest	4.01	0.77	1.64	.11	.31
	Posttest	4.28	0.95			
(3) Technology literacy and acceptance	Pretest	3.88	0.78	1.47	.15	.31
	Posttest	4.16	1.00			
(4) Social interaction and collaboration	Pretest	4.12	0.70	0.62	.54	.13
	Posttest	4.23	0.98			

4.3. Evaluators' observation on AI-facilitated creativity in DST

A total of 15 pieces of work were submitted, consisting of three individual projects, seven pairs, and four groups of three or four members. The results obtained through the three evaluation methods – peer, expert, and audience evaluation – are reported in Table 6. The mean scores of the three criteria for each group were derived from Peer evaluations by the 32 students involved, and Expert evaluations from a professional film producer and the course instructor. Audience evaluations were carried out via votes from 35 freshmen and sophomores, with four distinct awards annotated alongside their respective works.

Table 6. Results of three evaluation methods of AI-facilitated DST

	M of peer (#=32) and expert (#=2) evaluations			Vote count from audience evaluation (#=35)			
	Creativity & originality	Effective use of AI	Audiovisual quality	Master of storytelling award	AI visionary award	AI-driven visual effects award	Audience choice award
1 (#=2)	4.63	4.57	4.53	4	2	4	3
2 (#=3)	3.48	3.38	3.71	0	3	3	0
3 (#=1)	4.72*	4.62*	4.57*	5	10*	5	6
4 (#=2)	3.98	4.42	4.38	2	0	2	3
5 (#=4)	3.85	4.32	4.37	1	4	1	0
6 (#=2)	3.73	4.22	3.9	0	6	1	3
7 (#=3)	4.52	4.52	4.45	2	4	1	4
8 (#=3)	4.48	4.4	4.12	0	0	0	1
9 (#=4)	4.15	4.1	3.33	5	1	2	2
10 (#=2)	3.57	3.02	4.22	1	2	4	3
11 (#=1)	3.85	2.87	2.93	1	0	0	0
12 (#=2)	3.82	2.8	3.38	4	0	0	1
13 (#=2)	4.55	4.52	4.48	8*	3	9*	8*
14 (#=2)	3.93	3.88	4.3	2	0	3	0
15 (#=1)	3.82	3.6	3.72	0	0	0	1

Notes. 1. An asterisk (*) indicates the highest average score or the greatest number of votes received. 2. Peer and Expert evaluations use a 5-point Likert Scale, with results reported as mean scores. 3. Audience evaluations follow a one-person-one-vote-per-award system, with results tallied as vote counts.

The results indicated that Group 3 excelled in all three criteria in both Peer and Expert evaluations, achieving scores of 4.72 in Creativity and Originality, 4.62 in Effective Use of AI Tools, and 4.57 in Audiovisual Quality. Their performance was echoed in the audience's feedback, with Group 3 receiving the AI Visionary Award. Meanwhile, Group 13, which ranked third in all criteria (4.55, 4.52, and 4.48), was notably recognized by the audience, securing the Master of Storytelling Award for Creativity and Originality, the AI-Driven Visual Effects Award for Audiovisual Quality, and the Audience Choice Award, reflecting its broad appeal. Even though Group 1, which placed second in all three criteria (4.63, 4.57, 4.53), won none of the awards, but received nominations for all. On the other hand, Group 2, which received the lowest score in Creativity and Originality (3.48), Group 12, with the lowest score in Effective Use of AI (2.8), and Group 11, with the lowest score in Audiovisual Quality (2.93), did not receive any nominations for the corresponding awards. In general, the three evaluation methods produced quite similar results with minor variations.

Upon closer examination of the comments provided to these groups, certain noticeable patterns emerged. Utilizing the word cloud technique to emphasize the most prominent points within comments from peers, experts, and the audience, as depicted in Figure 3 to 6, a common theme became evident. Across all three criteria, and even within the audience's preferences, the concept of *story*

(故事) consistently stood out. These findings suggest that the essence of DST remains rooted in the story itself. While technology can enhance and enrich the presentation, it is the human narrative that remains at the core of creative expression.

Figure 3. Word cloud analysis on creativity and originality

Figure 4. Word cloud analysis on effectiveness of AI tools

Figure 5. Word cloud analysis on audiovisual quality

Figure 6. Word cloud analysis on the audience choice award

Detailed features of creativity outputs were observed through closer examination of comments given to each criterion and its corresponding awards. Excerpts for the analysis are presented in Appendix B. Regarding the Creativity and originality, distinct features were categorized into three aspects, as exemplified by comments in Excerpt 1. Firstly, there is a consistent emphasis on the value of imagination and originality, with projects that showcased novel and innovative storytelling approaches receiving praise. Secondly, the completeness and structural coherence of the narratives were highly regarded, highlighting the appreciation for well-plotted and organized storylines. Thirdly, the emotional impact of the stories significantly resonated with the audience's sentiment.

Concerning the effectiveness of AI tools, as demonstrated in Excerpt 2, comments can be categorized to highlight specific features enhanced by these tools, including Appropriateness of Images, Audiovisual Integration, Editing and Presentation. The comments consistently emphasize the importance of the appropriate and supportive usage of generative AI tools. They underscore that AI technology should serve as a facilitator rather than the central focus in DST, emphasizing the role of human creativity and narrative structure in guiding the storytelling process.

The third criterion, audiovisual quality, encompasses three key aspects. First, audiovisual execution, as reflected in comments about sound volume, soundtrack, visual effects, and animation quality, underscores the technical aspects of audio and visual components. Second, narrative delivery, assessed through the vividness of story content, congruence of picture and text, and the impact of sound effects on story immersion, emphasizes the storytelling quality. Additionally, engagement and accessibility, highlighted by subtitles that enhance understanding and a desire to continue watching, play a crucial role in audience engagement and accessibility.

Finally, when considering the general audience's preferences, comments reveal the key appealing features of DST. Firstly, the narrative should ignite the desire to follow its progression, engaging viewers throughout. Secondly, the content of the film should elicit a profound emotional impact on the audience, whether it invokes fear or touching, establishing a deep connection with

viewers. Lastly, the integration of images, sounds, and even subtitles with the narrative should be sufficient to facilitate immersion without overwhelming the viewing experience. Excerpt 4 provides further insights through comments that align with these preferences.

5. Discussion

5.1. EFL learners' perceptions of ai's facilitative role in creative tasks

The study aimed to investigate EFL learners' perceptions and attitudes towards AI-facilitated DST. A survey on technology-enhance creativity was implemented as a pretest and posttest, with participants' attitudes measured before and after an instructional intervention. The findings revealed a generally positive attitude in the pretest. Following the teaching intervention, attitudes exhibited significant improvement. This suggests that the intervention positively influenced participants' attitudes towards AI technology, thereby addressing the research question.

However, the study found no significant change in EFL learners' perceptions of creativity constructs – critical thinking and problem-solving, knowledge expansion, technology acceptance, and social interaction – after AI-facilitated learning. Before the intervention, social interaction was most favored, then knowledge expansion, critical thinking, and lastly, technology acceptance. After the intervention, knowledge expansion led, followed by social interaction, critical thinking, and technology acceptance. Despite minor shifts in attitudes, none had reached statistical significance, indicating a need for further research to understand the impact of AI on learning.

The preference for expanding knowledge over critical thinking may arise from the complexities of using AI tools, as suggested by participants' reflections during their presentations on creating digital stories. They favored AI tools that offer extensive functionalities. For example, CapCut was praised for its autonomous generation of video elements (Excerpt 5), and ChatGPT was commended for its efficient multitasking in story writing, translation, and information retrieval (Excerpt 6). The ability of AI to provide accurate results with minimal input was particularly valued. These findings, while highlight AI's contribution to enhancing the creative process, also explain the perceived improvement in efficient information and knowledge exchange.

During the editing phase, the participants encountered difficulties in finding images that matched their narratives or the intended genre. The main challenge lies in communication with AIs: the participants struggled to select appropriate keywords and provide detailed instructions to ensure accurate image generation (Excerpt 7); additionally, directing AIs to produce the desired narrative was time-consuming, with results often diverging from their original intentions (Excerpt 8). These challenges highlight the participants' frustrations and suggest why they perceived the two constructs – critical thinking and problem-solving, as well as technology acceptance – as particularly demanding in AI-assisted tasks.

Despite being considered neo-digital natives, typically viewed as adept at information technology, the participants still ranked their acceptance of technology low. This unexpected result may be attributed to the recent emergence of generative AI tools during the study, introducing a novel challenge even for this tech-savvy group. In the research by Kafai and Burke (2014), students who were unsure about AI reported discomfort with integrating it into their learning. This relationship between attitude and technology use was also supported in Chiu's (2017) study, which identified a positive attitude as a key determinant of technology adoption in teaching and learning. These findings address a pedagogical gap: the importance of not just understanding but also adeptly using new technologies must be emphasized in the education nowadays.

5.2. Observations of AI-facilitated creativity in digital storytelling

The evaluators' comments on the AI-facilitated DST suggested a high value was placed on creativity, originality, and emotional engagement. Creativity was seen in the imaginative and unexpected plot developments that were attractive and original. The structure and completeness of the narratives were praised for their coherency, indicating that well-organized storylines were appreciated. Emotional engagement was achieved when stories resonated with audiences on a sentimental level, such as evoking childhood memories. On the other hand, evaluators noted that AI tools enhanced creativity by providing images that complemented the storylines and audiovisuals. Audiovisual quality was regarded as critical, with execution focusing on the right fit to the theme. Narrative delivery was enhanced by images and sounds that immersed the audience, while engagement and accessibility were facilitated by subtitles and moderate use of animation and sound volume.

Overall, the evaluations from peers, experts, and the audience outlined the criteria for outstanding digital storytelling: it should capture the viewers' attention, emotionally engage them, and seamlessly integrate multimedia elements to provide an immersive but not overpowering experience. The evaluations further indicate that, although generative AI tools can augment supporting elements such as images, sounds, and subtitles, they may fall short in enhancing the sentimental aspects of storytelling which provide a human touch to the narrative.

The impact of AI on storytelling is an ongoing debate. Eapen et al. (2023) suggest that generative AI can improve storytelling, particularly at the start where blending different ideas can lead to more captivating and original stories. AI's capability of combining large amounts of information might give writers new options and directions that they might not think of on their own, adding more variety and potential to storytelling. However, as the narrative becomes more complex, AI may not adeptly handle sophisticated plot developments or the emotional intricacies that align with the storyteller's vision.

This limitation could be attributed to AI's dependence on patterns present in its training data. Firstly, utilizing the existing data may restrict innovation, as suggested by Fügener (2021), potentially diminishing diversity in thinking.

Granados (2022) also proposes that excessive reliance on AI could hinder the range of perspectives. Additionally, the training data that AI utilizes is originated from human creativity, suggesting that AI's creative output is essentially recombination of human ideas. Humans are not confined by data limitation, and thus possess the ability to generate new concepts, imagine novel scenarios, and express a range of emotions – such complexities that AI has not yet mastered. This distinction underscores AI's current role as an augmentative tool rather than a source of original creation.

Despite the debates over AI's potential to enhance human creativity, its role in education is viewed positively when AI is seen as a collaborative partner rather than just a tool for creation. AI's computational power can support problem-solving and data analysis, but its potential is unlocked when it collaborates with humans to enhance creativity. Marrone et al. (2022) provide a case in point: students working on open-ended science tasks with AI support experienced different levels of creative engagement. Those who saw AI as just a helper for tasks missed out on its full potential, while those who treated AI as a teammate discovered new avenues for creativity. This suggests that AI facilitates creativity, rather than generate it. Education strategies that focus on human-AI collaboration can reveal AI's ability to contribute significantly, even in complicated tasks.

5.3. Pedagogical implications of AIGC for creative language learning

The incorporation of AI technology into educational contexts holds significant pedagogical potential. In the present study, the participants' engagement with the generative AI tools exemplifies the adaptable functionality of AI tools; the participants' positive attitudes toward the experience also present promising pedagogical implementations for elevating EFL learners' creative language tasks.

Firstly, the positive influence of AI on nurturing creativity in EFL learners is undeniable, as seen in their enthusiastic engagement with a variety of creative tasks. Excerpt 9 serves as an example: the task drove the student to venture beyond standard classroom activities and resources. A practical suggestion for pedagogical implication is to encourage and facilitate this exploratory approach in educational settings. For instance, educators can design assignments that require learners to discover and utilize new AI tools, thereby fostering an environment that not only enhances their creative thinking but also equips them with problem-solving skills crucial for their educational growth. This experiential learning process, exemplified by a student's active search for AI tools, underlines the importance of learner initiative in the creative process and the effective integration of AI in language education.

Secondly, employing AI in language education significantly enhances EFL learners' proficiency in English. Vashee (2023) highlights the advantage of NLP systems for English users, emphasizing the need for proficiency to maximize their utility. As Excerpt 10 shows, even an English major struggled to communicate effectively with AI, illustrating the critical need for EFL learners to

develop precision in language use. In response, educators should incorporate tasks that require EFL students to construct exact and concise instructions for AI. This not only leverages AI as a language learning aid but also to advance learners' linguistic accuracy and technological fluency.

Thirdly, the adoption of AI within educational settings has been instrumental in enhancing learners' confidence and learning efficiency, which are critical components of successful educational outcomes. A practical pedagogical implication would be to systematically incorporate AI tools into the curriculum to facilitate these advantages. For example, educators can integrate intelligent tutoring systems for personalized feedback and employ AI-driven language tools to reinforce language skills, thereby not only improving the efficiency of the learning process but also bolstering learners' confidence in using the language. This approach aligns with UNESCO's (2019) findings on AI's potential to personalize learning and support teaching, suggesting that AI's role is not limited to improving efficiency but also includes fostering a generation of motivated and confident language learners.

6. Conclusion

This study explores the influence of AI on enhancing creativity in EFL learners via digital storytelling. The participants created DST by effectively use the target language, elevating their creativity with multimedia tools provided by AI, such as image selection, audiovisual synchronization, and tailored editing. Their feedback was overwhelmingly positive, crediting AI with broadening their knowledge and enhancing interactivity. Creativity emerged through emotionally resonant storylines and cohesive structures. Moreover, originality stood out as the most valued aspect of the creative process, underscoring that, while AI provide various supports for digital storytelling, the essence of creativity remains a distinctly human trait. As AI assumes the role of facilitator in creating supportive elements for storytelling, the importance of human imagination, ingenuity, and interpretative skills in shaping truly creative content becomes ever more apparent.

The research question (1) examined EFL learners' perceptions and attitudes toward AI-facilitated creative projects in language learning. Initial survey showed the participants' favorable attitudes, which were significantly enhanced after the teaching intervention. This suggests that the intervention positively influenced the participants' views of AI technology, suggesting the valuable impact of the pedagogical instructions on shaping learners' attitudes and perceptions.

Research Question (2) delved into the observable features of AI facilitation on creativity outputs through DST. By scrutinizing three evaluation methods and analyzing evaluators' comments, the study highlighted the significance of originality, narrative coherence, and emotional resonance within stories. It emphasized AI's role as a supportive tool that enhances storytelling through the inclusion of appropriate imagery, synchronized audiovisual elements, and seamless editing. The technical quality of audiovisuals, encompassing not only

sounds and images but also subtitles for viewer support, proved crucial for effective narrative delivery and audience engagement. Successful DST not only captivates but also emotionally connects with the audience, integrating multimedia elements to enrich the experience without overwhelming viewers.

While this study sheds light on the impact of AI-facilitated digital storytelling on EFL learners' creativity, certain limitations should be acknowledged. The teaching intervention's relatively short duration and focus on immediate post-intervention responses may have affected statistical significance. Future research could extend the study's timeline and delve into long-term effects, assessing sustained creativity development and lasting technology acceptance. In addition, a comprehensive examination of participants' language performance and content presentation skills could be incorporated. This would involve assessing factors such as grammar accuracy, vocabulary usage, coherence, and the overall effectiveness of communication within the context of AI-facilitated creative projects. By incorporating a thorough linguistic analysis, future studies could offer a more complete understanding of the impact of AI-facilitated interventions on both creativity and language proficiency development among EFL learners.

Statements and Declarations

References

Al-Amri, H.M. (2020). Digital storytelling as a communicative language teaching-based method in EFL classrooms. *Arab World English Journal, 11*(1), 270–281. https://dx.doi.org/10.24093/awej/vol11no1.20

Amabile, T. M. (2001). Beyond talent: John Irving and the passionate craft of creativity. *American Psychologist, 56*(4), 333–336. https://doi.org/10.1037/0003-066X.56.4.333

Amabile, T. M. (2017). Stimulate creativity by fueling passion. In E. A. Locke (Ed.), *The Blackwell handbook of principles of organizational behavior.* John Wiley & Sons, 345–356.

Baer, J. (2016). Chapter 6 – Implications of domain specificity for creativity training. In J. Baer (Ed.), *Domain specificity of creativity* (pp. 141–151). Academic Press. https://doi.org/10.1016/B978-0-12-799962-3.00006-9

Burmark, L. (2004). Visual presentations that prompt, flash & transform. *Media and Methods, 40*(6), 4–5.

Cao, Y., Li, S., Liu, Y., Yan, Z., Dai, Y., Yu, P. S., & Sun, L. (2023). A comprehensive survey of ai-generated content (AIGC): A history of generative AI from GAN to ChatGPT. *Journal of the Association for Computing Machinery, 37*(4), Article 111. https://doi.org/10.48550/arXiv.2303.04226

Chiu, T. K. F. (2017). Introducing electronic textbooks as daily-use technology in schools: A top-down adoption process. *British Journal of Educational Technology, 48*(2), 524–37. https://doi.org/10.1111/bjet.12432

Cranfield, D., Venter, I., & Daniels, A. (2023). Using ChatGPT to investigate trends in digital storytelling and knowledge sharing in higher education. *EDULEARN23 Proceedings*, 4217–4225. https://doi.org/10.21125/edulearn.2023.1119

De Cremer, D., Bianzino, N. M., & Falk, B. (2023, April 14). How generative AI could disrupt creative work. *Harvard Business Review.* https://hbr.org/2023/04/how-generative-ai-could-disrupt-creative-work

Dewaele, J. M. (2012). Personality in second language acquisition. In C. Chapelle (Ed.), *Encyclopedia of applied linguistics* (pp. 1–8). John Wiley and Sons, Inc.

Dörnyei, Z., & Ryan, S. (2015). *The Psychology of the Language Learner Revisited.* Routledge.

Eapen, T. T., Finkenstadt, D. J., Folk, J., & Venkataswamy, L. (July/August 2023). How generative AI can augment human creativity: Use it to promote divergent thinking. *Harvard Business Review, 101*(4), 56–64. https://hbr.org/2023/07/how-generative-ai-can-augment-human-creativity

Fernández-Fontecha, A. (2021). The role of learner creativity in L2 semantic fluency. An exploratory study. *System, 103,* Article 102658. https://doi.org/10.1016/j.system.2021.102658

Fügener, A., Grahl, J., Gupta, A., & Ketter, W. (2021). Will humans-in-the-loop become borgs? Merits and pitfalls of working with AI. *Management Information Systems Quarterly, 45*(3), 11–40. http://doi.org/10.25300/MISQ/2021/16553

Generation Z (2023). In *Wikipedia.* https://en.wikipedia.org/wiki/Generation_Z#

Granados, N. (2022, February 1). Human Borgs: How artificial intelligence can kill creativity and make us dumber. *Forbes.* https://www.forbes.com/sites/nelsongranados/2022/01/31/human-borgs-how-artificial-intelligence-can-kill-creativity-and-make-us-dumber/?sh=789fa0ed21a2

Greenstein, L. M. (2012). *Assessing 21st century skills: A guide to evaluating mastery and authentic learning.* Corwin Press.

Guilford, J. P. (1959). Three faces of intellect. *American Psychologist, 14*(8), 469– 479. https://doi.org/10.1037/h0046827

Harji, B. M, & Gheitanchian, M. (2017). Effects of multimedia task-based teaching and learning approach on EFL learners' accuracy, fluency and complexity of oral production. *The Turkish Online Journal of Educational Technology, 16*(2), 25–34.

Harvey, S. (2013). A different perspective: The multiple effects of deep level diversity on group creativity. *Journal of Experimental Social Psychology, 49*(5), 822–832. https://doi.org/10.1016/j.jesp.2013.04.004

Kafai Y. B., & Burke, Q. (2014). *Connected code: Why children need to learn programming.* The MIT Press. https://doi.org/10.7551/mitpress/9992.001.0001

Lambert, J. (2013). *Digital storytelling: Capturing lives, creating community.* Routledge.

Linxweiler, J. A. (2016). *Creativity and innovation in economics.* GRIN Verlag. Retrieved from https://www.grin.com/document/341758

Lomas, D. (2023, April 13). *Harnessing the power of AI for creative facilitation.* AI and Experience Design. https://aixd.substack.com/p/harnessing-the-power-of-ai-for-creative

Marquis, E., & Vajoczki, S. (2012). Creative differences: Teaching creativity across the disciplines. *International Journal for the Scholarship of Teaching and Learning, 6*(1), Article 6. https://doi.org/10.20429/ijsotl.2012.060106

Marrone, R., Taddeo, V., & Hill, G. (2022). Creativity and artificial intelligence: A student perspective. *Journal of Intelligence, 10*(3), Article 65. http://doi.org/10.3390/jintelligence10030065

NexMutation Technology. (2023, May 14). *The rise of Generative AI: Unleashing creativity and innovation.* https://www.linkedin.com/pulse/rise-generative-ai-unleashing-creativity-innovation-technology

Noddings, N. (2013). Standardized curriculum and loss of creativity. *Theory into Practice, 52* (3), 210–215. https://www.jstor.org/stable/43893885

Raj, H., & Saxena, D. R. (2021). Scientific creativity: A review of researches. European Academic Research, 4(2), 1122–1138.

Resnick, M. (2023, April 24). AI and creative learning: Concerns, opportunities, and choices. *Medium.* https://mres.medium.com/ai-and-creative-learning-concerns-opportunities-and-choices-63b27f16d4d0

Ritter, S. M., & Mostert, N. (2017). Enhancement of creative thinking skills using a cognitive-based creativity training. *Journal of Cognitive Enhancement, 1,* 243–253. https://doi.org/10.1007/s41465-016-0002-3

Robin, B. R. (2008). Digital storytelling: A powerful technology tool for the 21st century classroom. Theory into Practice, 47, 220–228.

Robin, B. R. (2016). The power of digital storytelling to support teaching and learning. *Digital Education Review, 30,* 17–29. https://doi.org/10.1344/der.2016.30.17-29

Runco, M. A. (2014). *Creativity: Theories and themes: Research, development, and practice* (2nd ed.). Elsevier Academic Press.

Simonton, D. K. (2012). Creativity, problem solving, and solution set sightedness: Radically reformulating BVSR. *The Journal of Creative Behavior, 46*(1), 48–65. https://doi.org/10.1002/jocb.004

Suzuki, S., Yasuda, T., Hanzawa, K. & Kormos, J. (2022). How does creativity affect second language speech production? The moderating role of speaking task type. *TESOL Quarterly, 56*(4), 1320–1344. https://doi.org/10.1002/tesq.3104

Tan, C., Lau, X., Kung, Y., & Kailsan, R. (2016). Openness to experience enhances creativity: The mediating role of intrinsic motivation and the creative process engagement. *Journal of Creative Behavior, 53*(1), 109–119. https://doi.org/10.1002/jocb.170

Torrance, E. P. (1998). *Torrance tests of creative thinking: Norms-technical manual: Figural (streamlined) forms A & B.* Scholastic Testing Service.

UNESCO (2019). *Artificial intelligence in education: Challenges and opportunities for sustainable development.* Technical report, United Nations, Educational Scientific and Cultural Organization. Available online at: https://unesdoc.unesco.org/ark:/48223/pf0000366994

Vashee, K. (2023). Making Generative AI effectively multilingual at scale. *ModernMT Blog.* https://blog.modernmt.com/making-generative-ai-multilingual-at-scale/

Verhoeven, L., & Vermeer, A. (2002). Communicative competence and personality dimensions in first and second language learners. *Applied Psycholinguistics, 23*(3), 361–374. https://doi.org/10.1017/S014271640200303X

Vincent-Lancrin, S., González-Sancho, C., Bouckaert, M., de Luca, F., Fernández-Barrerra, M., Jacotin, G., Urgel, J., & Vidal, Q. (2019). *Fostering students' creativity and critical thinking: What it means in school. Educational Research and Innovation.* OECD Publishing. https://doi.org/10.1787/62212c37-en

Wu, J., & Chen, D. T. V. (2020). A systematic review of educational digital storytelling. *Computers & Education, 147,* 103786–103716. https://doi.org/10.1016/j.compedu.2019.103786

Wu, T., He, S., Liu, J., Sun, S., Liu, K., Han, Q.L., & Tang, Y. (2023). A brief overview of ChatGPT: The history, status quo and potential future development. *IEEE/CAA Journal of Automatica Sinica, 10*(5), 1122-1136. https://doi.org/10.1109/JAS.2023.123618

Yang, Y. T. C., Chen, Y. C., & Hung, H. T. (2020). Digital storytelling as an interdisciplinary project to improve students' English speaking and creative thinking. *Computer Assisted Language Learning, 35*(4), 840–862. https://doi.org/10.1080/09588221.2020.1750431

Zhang, C., Zhang, C., Zhang, M., Kweon, I.S. (2015). Text-to-image diffusion models in Generative AI: A survey. *Journal of Latex Class Files, 14*(8),1–13. Retrieved from https://arxiv.org/pdf/2303.07909.pdf

Appendix A

The finalized Survey of Technology Enhanced Creativity (STEC)

1. Using AI tools can improve my creative thinking ability.
2. I believe AI tools can provide innovative approaches to problem-solving.
3. Using AI tools can expand my knowledge in various academic fields.
4. AI tools support me in analyzing and evaluating different options to select the most effective solution.
5. I believe AI tools can play an important role in teamwork.
6. Using AI tools can help me better understand course content.
7. I believe AI tools will have an important position in the future workplace.
8. Using AI tools encourages me to embrace different perspectives and be flexible when solving problems.
9. I believe AI tools can help me achieve better academic performance.

10. Using AI tools can help me manage my time more efficiently.
11. I believe AI tools have the potential to improve my critical thinking skills.
12. I believe AI tools have the potential to enhance my independent learning ability.
13. Using AI tools can help me be more strategic in problem-solving.
14. I believe AI tools facilitate reasoning induction in various domains of knowledge.
15. I am confident in my ability to use AI tools.
16. I think that AI tools are easy to learn and use.
17. I am willing to invest time and effort to learn how to use AI tools.
18. AI tools help me generate diverse ideas and explore various possibilities when solving problems.
19. I think that using AI tools for creativity can improve collaboration among teammates.
20. I believe that AI tools can help me better appreciate the creative ideas of others.
21. I think that AI tools can help create a more inclusive environment for diverse creative perspectives.
22. I feel comfortable using AI when at work or in daily life.
23. Using any type of AI can be a pleasant experience for me.
24. Using AI tools fosters communication and collaboration with others in idea exchange.
25. I know how to access and use AI at work or in daily life.

Appendix B

Excerpts

Excerpt 1
(1) Imagination and Originality: "Very imaginative." "Unexpected plot." "The content of the story is very attractive and feels original."
(2) Narrative and Storytelling: "The story is interesting, rich but not vague." "The story plot is very complete."
(3) Emotional Engagement: "The entire story is very touching." "The content of the story also has a feeling of childhood cartoons."

Excerpt 2
(1) Appropriateness of Images: "The direction of the story matches the pictures." "The overall layout of the story is interesting and matches the content."
(2) Audiovisual Integration: "The screen moves, so cool." "The sound and speed of speech match very well."
(3) Editing and Presentation: "Well edited." "I think they integrated with the script very well, showing no forced feeling of using any particular special effect."

Excerpt 3

(1) Audiovisual Execution: "The story is imaginative, and the sound and AI dubbing are just right." "The soundtrack and visual effects are chilling but very fitting to the theme."

(2) Narrative Delivery: "The story combines some sound effects to immerse the audience more into the story." "The story background and soundtrack provide visual and auditory enjoyment to the audience."

(3) Engagement and Accessibility: "The film comes with Chinese subtitles." "Used animation, and the overall text and sound volume are moderate."

Excerpt 4

(1) Narrative Engagement: "The overall story is very attractive, making people want to know the followings of the story."

(2) Emotional Impact: "Before watching this film, I thought it was about my own dreams, but it turned out to be a horror movie. It scared me. Therefore, it's the film I find most unforgettable."

(3) Audio: "The sound of footsteps and everyone talking was well matched, making the story easier to understand." "Having subtitles in both English and Chinese is a big plus."

Excerpt 5. "CapCut, because this AI tool is strong. It can automatically generate the image for the video, the sound, and the subtitles." (S3)

Excerpt 6. "ChatGPT is very useful. I can ask it most of the question and it knows the answer. Furthermore, the answer is very clear. I think it is useful than Google." (S21)

Excerpt 7. "The top difficulty is finding a suitable picture to complement our story content. We wanted to deliver the story in a more anime style, but the AI was not so good at creating anime. So, we spent a lot of time on this." (S19)

Excerpt 8. "The story we wanted to end badly, but it seems like no matter what keywords I gave to AI, it still gave me a happy ending." (S24)

Excerpt 9. "We originally wanted to use CapCut to generate the video; however, it could only accept Chinese prompts and provide the video in Chinese. Therefore, we decided to use SMUGO to generate the pictures, and then we used Clipchamp to edit the video, which was a little bit challenging." (S26)

Excerpt 10. "Sometimes what AI created didn't follow my instructions. It took time to make my instructions more specific to let AI know what I wanted." (S11)