DIGITALEDUCATIONREVIEW

Creativity and artificial intelligence: A study with prospective teachers

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ABSTRACT

Artificial Intelligence (AI) brings enormous opportunities into learning, teaching, and assessment processes. Among them, it is convenient to explore its ability to channel students' creativity, which is described as a basic competence in the training of people with both the OECD and the recent Spanish LOMLOE law pointing to the need to foster it in educational settings. In this context, the objective of this research is to explore the creative potential of prospective elementary school teachers related to storytelling, via a project including the rational use of AI generative tools. A combination of qualitative and quantitative instruments was used to get insight on the implications of those AI tools in the creative process and to gain understanding on the concerns of prospective teachers about AI at both their training and future teaching practice. The results show the potential of AI from an educational point of view, specially in self-assessment and co-evaluation processes, since it allows confronting not only the result of the creative task, but also the process itself by reflecting on the asked questions. Finally, the importance of continuing research on the ability to ask questions (a creative skill in itself) in the new context of AI is discussed.

KEYWORDS: creativity, artificial intelligence, prospective teachers, storytelling

1 INTRODUCTION

Currently, the debate on the importance of creativity in education has been intensified. This is largely because 2022 PISA Tests (OECD, 2019) included the assessment of creativity in educational systems, paying attention to written and visual creative expression and the solution of scientific and social problems. Spain aligned with this current of opinion with its recent educational law, dictating that "creativity will be worked on all subjects" (LOMLOE, 2020: 1222874). This highlights the transdisciplinary nature of creativity and the coexistence of several creativity domains: verbal, scientific, artistic etc. (Runco and Bahleda, 1986; Conti et al., 1996; Kaufman, 2012). Merrotsy 's (2013) differentiated between Creativity (with a capital letter), which is what great geniuses possess, and creativity (with a lowercase letter), which is a less notable yet everyday useful and necessary one. Besides, Kaufman and Beghetto (2009) in their theory of the 4 Cs, even divide the last one in two: Little-c, which refers to daily actions that affect the individual and their environment; and Mini-c, essential for the formation of mental representations and linked to the creativity inherent to the teaching-learning process. These last two are those that can be promoted at school in a formal learning environment.

It is assumed that the training of teachers (preservice and in-service) is a key aspect to promote creativity. However, current educational plans do not pay enough attention to creativity, and teachers do not feel supported when converting policies that emphasize creativity into real practices (Patston et al., 2021). Likewise, they are not receiving adequate training to help them plan and improve programs aimed at developing a creative environment in their classrooms (Al-Dababneh, 2019). In short, it is essential that teachers have cultivated their own creativity to inspire it in their students (Chan and Yuen, 2014; Yates and Twigg, 2017). They must believe that they are capable of it, be willing to do it and understand what teaching creatively entails (Hong et al., 2011). They must be able to provide creative examples to their students so that they proceed to *imitatio*. This imitative model can be aligned with the learning of creativity through emulation (Martín-Ezpeleta et al., 2024). Each student who participates in a cooperative problem-solving task brings different mental attributes, including abilities, knowledge, habits, attitudes, and values. Thus, we are not only adding creativities, but the most skilled students are teaching the less skilled ones, stimulating the divergent thinking arising from interaction.

A good starting point to raise awareness among educators would be to offer them a correct conceptualization of creativity, making them aware of mini- and little-creativity. This would be the previous step to a desirable metacognitive reflection on creativity. For example, Lee and Portillo (2022) study with pre-service teachers revealed that a creativity course, whose main objectives included the promotion of creative attitudes, understanding the nature of creativity and the application of creative strategies in various situations, strengthened their creative mind and increased their creative self-confidence. This had transferable effects to specific domains: participants increased their self-assessment of creativity in specific areas as the course progressed, which suggested an improvement in the application of creative strategies in their academic and everyday lives. Another step in teacher training would be to define the measure of creative success in each curricular context (Newton, 2013). Similarly, other authors (Benedek et al., 2016) point out that the recognition and

appreciation of creative ideas constitute an important condition for effectively promoting creativity in the classroom.

A suitable method to develop creative abilities and develop written competence is storytelling, which has experienced an emerging trend in the educational context (Robin, 2016; Wu and Chen, 2020). Hamilton (2019) proposes adding reflection to the pedagogical mix to achieve greater understanding and connection to the writing process. Thus, it can be concluded that teachers should design writing tasks using methods like storytelling. This has also been explored in digital contexts, although less than expected given their potential (Echegoyen-Sanz et al., 2024; Tang et al., 2022). Great attention has been paid to digital storytelling, even though sometimes they are educational experiences with a naive conceptualization of creativity since the objective is usually more to raise awareness of social problems or directly to train of writing or designing multimodal texts (Daskolia et al., 2015; Tackvic, 2012). Some studies, however, do focus on the creativity of the digital products and evaluate it (Di Blas, 2022; Echegoyen-Sanz and Martín-Ezpeleta, 2021).

In this context of digital learning AI is almost missing, even though it offers enormous opportunities in the processes of learning, teaching, evaluation and even management of educational organizations and systems (OECD, 2021). Collaboration with AI fosters co-creativity: the novelty arises through shared ideas and actions, which in turn would imply a perception of the impact of said novelty (Walsh et al., 2014). Additionally, it prompts students to engage in metacognitive reflection. There are not many studies due to its unconventionality, but there are some exploratory studies (like this one) concluding the potential of AI to foster creativity in the classroom (Habib et al., 2024; Tsao and Nogues, 2024).

To date there are some studies with preservice teachers demonstrating the didactic potential of AI. Urban et al. (2023) determined that ChatGPT serves as support to delve deeper into ideas in problem-solving. The use of AI allows the problem space to be explored in more detail and, therefore, developing more elaborated solutions and inspiring novel combinations of concepts, contributing to more original final solutions. Likewise, Vicente-Yagüe et al. (2023) investigated the creative possibilities of AI for the development of writing in two phases, one of individual execution and another from the use of ChatGPT, demonstrating the potential of hybrid collaboration human-AI and determining that a new language teaching model based on the writing-creativity-AI trinomial can begin to be explored. On the other hand, Li (2024) observed that playing with language through interaction with ChatGPT allows exploring the fluidity and complexity of composition processes through co-writing. She defends the use of AI limitations (lack of experience, emotion, and awareness) to develop students' critical awareness about language and improve their linguistic model using feedback.

In view of this, the objective of this study is to explore the potential of AI tools to enhance students' creativity (such as storytelling abilities) and foster their creative metacognition, as well as to get insight into the use of generative AI tools by prospective teachers, and their concerns about its implications in their future practice.

2 METHODOLOGY

2.1 Participants

The selection of the sample was carried out by means of non-probability sampling (Hernandez et al., 2010), during the second semester of the 2023-2024 academic year. Participants were students in their third year of the grade in Elementary Education Teaching (N = 42). All of them agreed to participate in the study after receiving information regarding the research aims and data treatment procedures, as it is dictated by the Ethics Committee of the University of Valencia. The sample is representative of the typical population of that year at the mentioned grade: age ranges from 20 to 28, with a mean value of 21.2 and a standard deviation of 2.0; and a gender heterogeneous distribution with 38 (90.5%) female and 4 (9.5%) male students.

2.2 Description of the intervention

The teaching unit consisted of both individual and collaborative tasks, distributed in a four-stage structure. The main aim was to develop the potential of students to create stories that they could take advantage from in their future practices, while effectively integrating the use of AI. Firstly, students were distributed into 10 working groups of 4 or 5 people. Each group was given 5 Story Cubes (a collaborative board game consisting of dice with figures in each face). Firstly, students were asked to throw the dice and create a story containing scenes corresponding to all the figures of the resulting dice's faces. This game-like approach with open-ended nature encourages participants to interpret prompts freely, reducing the likelihood of memory conformity, which in turn may foster creativity through the establishment of a distended environment conducive to dialogue (Weder et al., 2019). They also created a datasheet of their story including the topic, characters, contextualization, and the educational value. Students were specifically asked not to use any kind of generative AI tool to complete this task and they were supervised by the researchers thoroughly during its development.

Secondly, students completed the adapted version of the Global Students Survey (GSS) via Google Forms. They were kindly asked to respond sincerely, and researchers were available to answer any given question. Thirdly, the students used ChatGPT v.3.5 as a generative AI tool to write an alternative version of their story. Both the input prompts and the output given by the AI tool were collected and analyzed. Finally, students compared their original story with the one produced by the generative AI tool to create a final version of the story. Specifically, they were asked to choose between their initial version, the one provided by ChatGPT or a combination of both, based on their own judgement. Moreover, they wrote an essay justifying their decision and providing information about the whole decision-process.

2.3 Data collection and analysis

This is an exploratory and mixed experimental research, using both quantitative and qualitative methods (Bisquerra, 2009). To get insight into the use of generative AI tools by undergraduate students, as well as their concerns about its implications in their future practice as teachers, an adapted version of the 2023 international GSS was used. This survey has been conducted in 15 countries, including Spain, and provides evidence about the modification of the educational landscape by the availability of AI tools.

Qualitative research methods were applied to analyze the creativity of the final stories generated during the intervention. Firstly, all stories were iteratively read by the researchers, followed by their interpretation and summarization. Then, after the familiarization with the narrations, the coding associated with the components of creativity and the characterization of the data were generated. In general, there is both high diversity and a lack of standardized instruments to assess stories creativity. Echegoyen-Sanz and Martín-Ezpeleta (2021) developed a 12-folded framework to qualitatively assess the creativity of a digital story, based on the works of Yilmaz and Gotkas (2017), Alhusaini et al. (2014), Peinado et al. (2010), and Petersen et al. (2008). An adapted version of this framework is used in this study to qualitatively analyze the stories generated by students. Specifically, the categories corresponding to the narration of the story (type of narrator, temporal disorder, dialogues, etc.), the characters (men or women, children, adults, fantastic creatures) and the inclusion of aesthetic-artistic ensembles (dialogues between text, indirect or direct references to other literary or artistic works, etc.) were used. The total creativity score is obtained as the sum of all categories (max. score is 17). Data analysis was carried out by using the software SPSS v.28.

3 RESULTS AND DISCUSSION

3.1 Prospective teachers' use and concerns about generative AI tools

Regarding the results corresponding to the adapted version of the GSS, those shed light into the massive integration of generative AI tools at the daily practices of undergraduate students. Firstly, it is noteworthy that almost all participants used generative AI tools (92.9%) for their university endeavors, either less than once a week (57.1%) or a couple of times a week (19%). Secondly, they mostly use AI tools to generate initial drafts or ideas for assignments (33.3%), understanding complex concepts (19.0%) or researching for assignments and projects (16.7%) (Figure 1).

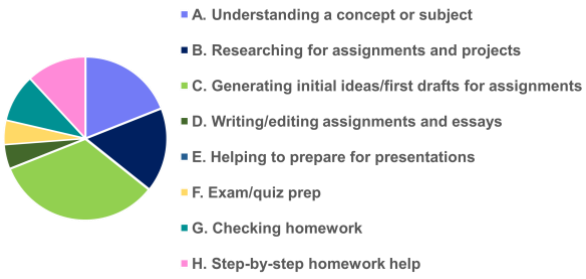

Figure 1. Results corresponding to item 3 of the adapted GSS: "How do you mostly use AI for university work?"

Among all the reasons why using AI tools, students mentioned primarily the reduction of time investment on doing tasks (23.8%) and the possibility of being more creative with assigned tasks (19.0%). Despite this fact, when asking for help students majorly resort to course materials (23.8%), followed by AI tools (21.4%), peers (19.0%) and free online resources, whereas professors or teaching assistants are scarcely asked for help (9.5%). Nevertheless, when considering assessed works, students show disparity of opinions (52.4% think that universities should limit the use of AI, whereas 45.2% believe that AI should be promoted in that context), even though they are not sure about how assessment should be adapted to this new scenario (54.8%). Instead, students agree that in the assessed works more guidance should be given around the use of AI (50.0%) and the need for more monitoring in person assignments (21.4%). On the other hand, participants are concern about being given inaccurate information (40.5%) and the feeling of cheating on tasks (23.8%) (Figure 2).

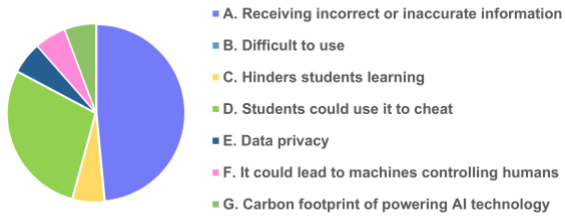

Figure 2. Results corresponding to item 9 of the adapted GSS: "What are your concerns, if any, about using generative AI in education?".

To overcome those limitations, students suggest involving more human expertise to assist their learning process (40.5%). Therefore, although they resort to AI or course materials to solve their questions, they still believe that the expertise of professors is unique (Figure 3).

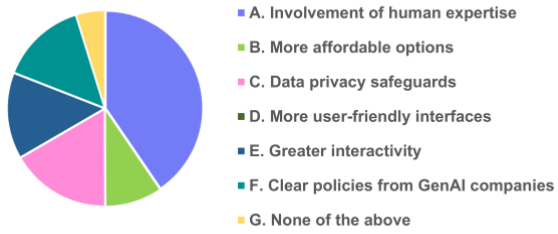

Figure 3. Results corresponding to item 10 of the adapted GSS: "What improvements, if any, would you like to see in generative AI to assist your learning?".

At this point it is important to highlight that participants feel mostly curious when using AI tools (31.0), but also indifferent (26.2), guilty (16.7%) and fearful (14.3%), which may be related to the novelty of those tools and the concern about their proper or acceptable use in the academic context. Despite those feelings, students argue that their understanding of complex concepts improves with the use of AI tools (33.3%), and they are more capable of manage their work overload (21.4%), which is in consonance with their motivations for using them. Finally, it is important to note that most students would like to receive specific training on AI tools at the university (76.2%) and they mainly think that AI would be to some extend useful at their future teaching career.

These results are analogous to the ones reported by the Chegg.org at the 2023 GSS (Chegg.org, 2023): Spanish students are in general more prone to use AI generative tools (62%) in comparison to the worldwide sample (40%); the top three reasons why using AI are helping with the learning process (53%), reducing the time investment on tasks (44%) and providing a more creative using of learning (39%); and the main improvement of AI assisted learning that students suggest is the implication of human expertise (55%). Given the high rate of students that use AI tools for learning, which is thought to be increasing overtime (Chen et al., 2020), it is essential to consider their opinions and concerns about the role of

AI on their learning experience and creativity (Chen et al., 2023). That would be the first step in the design of didactic interventions aiming to promote their creativity and simultaneously provide guidance about the effective, proper and acceptable use of AI in the academic context (Cotton et al., 2024).

3.2 Analysis of the process of creative metacognition in storytelling promoted by AI tools

Table 1 shows an overview of the 10 stories generated by students. Regarding the creativity scores, conceptualized as described by Echegoyen-Sanz and Martín-Ezpeleta (2021), it is in general average: values rank from 6 to 16.

	Number of AI queries	Final version and thematic	Creativity score
Story 1	3	Original (about bullying)	10
Story 2	1	Original (about solidarity)	6
Story 3	2	Minor modifications (about empowerment)	12
Story 4	4	Major modifications (about empowerment)	10
Story 5	1	Minor modifications (about nature and friendship)	6
Story 6	2	Major modifications (about nature and friendship)	16
Story 7	2	Original (about stereotypes)	13
Story 8	1	Minor modifications (about solidarity)	10
Story 9	2	Minor modifications (about solidarity)	12
Story 10	2	Minor modifications (about adventure)	15

Table 1. Qualitative analysis of the stories generated by the different groups.

Nevertheless, it must be considered that the assessment of creativity in this study is based on a single story, neglecting other possible creative products, such as videos or images (González-Zamar and Abad-Segura, 2020). Indeed, some studies have proven that the focus of the creativity assessment (person, product, process, etc.) may interfere in the obtained result (Long et al., 2022), since creative endeavors integrate an interplay of inter- and intra-phycological elements (Huang et al., 2021) as well as social and cultural factors (Glaveanu et al., 2020). Moreover, creativity is thought to be a multidimensional construct related to multitude of areas of knowledge such as literature, science, arts, music, or math (Kaufman and Sternberg, 2019). Consequently, students may display higher or lower creativity in each area, depending on their personal profile, experiences, environment and interests (Barbot et al., 2018).

Among all the final versions of the stories provided by students, 30% were the original ones created by them (without using AI) and 50% were the original versions with minor modifications, whereas scarcely the 20% of stories include major corrections, both provided by the AI generative tool. In addition, it is important to consider that 70% of students formulated more than one query to the AI tool in the purpose of choosing between their original version or a modified one. Specifically, 50% of them performed two queries, whereas 10% performed either 3 or 4 queries.

Further analysis of those queries reveal that students tend to firstly provide slight guidance of what they expect from the AI tool, for example given just keywords or the description of the dice's faces: "Please, write a children's story with educational purposes that includes: a person who steals, a candle, a diamond necklace, a telephone and a cart" (Group 9). Then, they generally discard the initial version provided by the generative AI tool. Consequently, they formulate a second query being more specific about what they would like to include in their story, such as events, names of characters or scenarios: "Please, write a story for children with educational value that includes the following elements: a thief, a candle, a diamond pendant, a telephone and a cart. And, that it includes the following characters: Mariona, villagers, Rodríguez, the horse Margall, Cayetana and Mariona's mother. We want the story to be funny and to present ethical values. Our goal is to create a fun story for children, but one that would also teach them values" (Group 9). Mainly, students prefer the outline of their original stories, therefore, the subsequential queries tend to be more specific: "We liked the first proposal of the AI, but we didn't want to do it without our initial characters. That is why we specified this aspect in the second question. We consulted the AI to see if it could give us a different and improved version of our story, so that it would be more interesting and fun for children, and that the didactic value would be more marked. Finally, we chose the first version, because it already met what we were looking for and we thought it more understandable for children" (Group 2). Considering the theme of the stories created by students, those were mainly related to ethical values or social challenges, such as bullying, solidarity, empowerment of children, nature and friendship (Table 1). Characters were mainly people and scenarios were based on everyday life (70% of stories). In this respect, students argue that this sort of stories may be more understandable for elementary students since they may relate to that context. Nevertheless, 30% of stories include imaginary characters such as animals, ogres, and pirates.

In those cases where students decided to include modifications to their stories provided by the AI tool (either at the first or subsequent queries), those modifications mainly dealt with more in-depth descriptions of characters or scenarios, as well as linguistic resources, such as rhetorical figures or dialogues: "The glowing candle she had taken with her became a reminder that light always prevails over darkness, and that honesty is always the best choice" (Group 1); "We want to point out that the story provided by the AI uses more adjectives and connectors than our version. Therefore, we decided to incorporate them to make the story more complete" (Group 4); "In our narration of the story there weren't dialogues and in the AI version we did notice that dialogues appeared between the characters. Therefore, we incorporated dialogues to improve our story" (Group 8). Despite including some modifications in their stories, students generally maintained the essence of their outline and the tone of the narration: "We have chosen the story prepared by us because it uses clearer and simpler language in order to reach our young audience" (Group 1); "We have based the final version of the story on our own original version to maintain its essence, but we also think it is important to include information from artificial intelligence sources in order to make our text more complete, well-written and structured" (Group 6).

All those comments shed light into the opportunities and challenges that generative AI tools may bring into education. On one hand, students are aware about the potential of those tools to improve their learning process, in terms of generating new ideas and perspectives but also to enhance their writing skills. On the other hand, it must be considered that in this teaching intervention students were specifically asked to create a story by themselves prior to consulting the generative AI tools. This fact may be crucial for the overall learning process because they are supposed to

reflect, think creatively, and work collaboratively before using AI technologies. In this context, some studies point out the need to design guided interventions, like the one here proposed, to foster the creative competences of students as well as their learning outcomes (Ng et al., 2023).

4 CONCLUSIONS

The integration of AI tools, specifically generative AI, into educational settings holds significant promise for enhancing undergraduate students' creativity (Sawyer and Henriksen, 2024; Baidoo-Anu and Ansah, 2023). Through a structured intervention involving both individual and collaborative activities, this study explored the potential of AI tools to enhance students' storytelling capabilities within the context of elementary education teaching. Findings suggest that while generative AI tools can offer valuable assistance in generating story alternatives and providing linguistic enhancements, students often maintain the essence and tone of their original narratives. Moreover, students exhibit a mix of curiosity, indifference, guilt, and fear when using AI tools, highlighting the need for guidance and training in their proper utilization within academic contexts (Mishra and Henriksen, 2024). In this context it is essential to consider students' opinions and concerns regarding the integration of AI tools into their learning experiences. While students recognize the potential benefits of AI in reducing time investment and fostering creativity, they are concern about accuracy, cheating, and the role of human expertise. This indicates a need for universities to provide clearer guidance and support regarding the use of AI tools, as well as to incorporate training on AI tools relevant to students' future careers (Zimmerman, 2018).

Furthermore, the assessment of creativity in storytelling tasks reveals both opportunities and challenges associated with the use of AI tools. While students demonstrate the ability to incorporate AI-generated elements into their narratives, they also emphasize the importance of maintaining their original ideas and expressions. This suggests that AI tools, as well as other technology resources can serve as valuable supplements to students' creative processes but should not replace the critical thinking and collaborative skills inherent in traditional storytelling approaches. These results are in line with prior studies exploring the creativity of generative AI tools in comparison to human creativity, which reveal that although AI tools show high creativity performance, human ideas catalogued as creative often excel those (Koivisto and Grassini, 2023).

It is important to address students' creative metacognition so that they become aware of their creative processes, rather than obsessing over generating the best artistic product. AI greatly facilitates this process by enabling self-assessment or co-assessment in cooperative tasks. These processes involve self-confrontation with the enrichment of one's own creative product, and the opportunity to observe the gradual enrichment of the product. Future research will delve deeper into this metacognitive reflection. To do this, sample size will be expanded, and digital stories will be prepared individually. The research will be completed with semi-structured interviews at different phases of the process and a focus group to gather the final reflections of the students in a creative dialogue.

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REFERENCES

Al-Dababneh, K. A., Al-Zboon, E. K., & Ahmad, J. (2019). The creative environment: teachers' perceptions, self-efficacy, and teaching experience for fostering children's creativity. *Early Child Development and Care*, 189(10), 1620-1637. https://doi.org/10.1080/03004430.2017.1400969

Alhusaini, A. A., Maker, J. C., & Deil-Amen, R. (2014). What is creativity: Teachers' beliefs about creativity in students' written stories. *Zbornik Instituta za pedagoska istrazivanja, 46*(1), 162-180. https://doi.org/10.2298/ZIPI1401162A

Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *Journal of AI, 7*(1), 52-62. https://doi.org/10.61969/jai.1337500

Barbot, B., Besançon, M., & Lubart, T. (2018). Creative potential in educational settings: Its nature, measure, and nurture. In T. Cremin (Ed.), *Creativity and Creative Pedagogies in the Early and Primary Years* (pp. 12-22). Routledge. https://doi.org/10.4324/9781315617305

Benedek, M., Nordtvedt, N., Jauk, E., Koschmieder , C., Pretsch, J., Krammer, G., &Neubauer, A.C. (2016). Assessment of creativity evaluation skills: A psychometric investigation in prospective teachers. *Thinking Skills and Creativity, 21,* 75–84. https://doi.org/10.1016/j.tsc.2016.05.007

Bisquerra, R. (2009). *Metodología de la Investigación Educativa* (2nd ed). La Muralla.

Chan, S., & Yuen, M. (2014). Personal and Environmental Factors Affecting Teachers' Creativity-Fostering Practices in Hong Kong. *Thinking Skills and Creativity*, 12, 69-77.

Chegg.org (2023). *Global Student Survey*. Tides Foundation. https://www.chegg.org/global-student-survey-2023

Chen, X., Xie, H., Zou, D., & Hwang, G. J. (2020). Application and theory gaps during the rise of artificial intelligence in education. *Computers and Education: Artificial Intelligence, 1*, Article 100002. https://doi.org/10.1016/j.caeai.2020.100002

Chen, Y., Jensen, S., Albert, L. J., Gupta, S., & Lee, T. (2023). Artificial intelligence (AI) student assistants in the classroom: Designing chatbots to support student success. *Information Systems Frontiers, 25*(1), 161-182. https://doi.org/10.1007/s10796-022-10291-4

Conti, R., Coon, H., & Amabile, T. (1996). Evidence to support the componential model of creativity: Secondary analyzes of three studies. *Creativity Research Journal*, *9*, 385-389. https://doi.org/10.1207/s15326934crj0904_9

Cotton, D. R., Cotton, P. A., & Shipway, J. R. (2024). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International, 61*(2), 228-239. https://doi.org/10.1080/14703297.2023.2190148

Daskolia, M., Kynigos, C., & Makri, K. (2015). Learning about Urban Sustainabilty with Digital Stories Promoting Collaborative Creativity from a Constructionist Perspective. *Constructivist Foundations*, 10(3), 388-396.

Di Blas, N. (2022). Authentic Learning, Creativity and Collaborative Digital Storytelling: Lessons from a Large-Scale Case-Study. *Educational Techology & Society*, 25(2), 80-104.

Echegoyen-Sanz, Y., & Martín-Ezpeleta, A. (2021). Creatividad y ecofeminismo en la formación de maestros: análisis cualitativo de cuentos digitales. *Profesorado: revista de currículum y formación del profesorado, 25*(1), 24-44. https://doi.org/10.30827/profesorado.v25i1.15290

Echegoyen-Sanz, Y., Morote, Á., & Martín-Ezpeleta, A. (2024). Transdisciplinary education for sustainability. Creativity and awareness in teacher training. Frontiers in Education, 8, 1327641. https://doi.org/10.3389/feduc.2023.1327641

Glaveanu, V. P., Hanchett Hanson, M., Baer, J., Barbot, B., Clapp, E. P., Corazza, G. E., ... & Sternberg, R. J. (2020). Advancing creativity theory and research: A socio-cultural manifesto. *The Journal of Creative Behavior, 54*(3), 741-745. https://doi.org/10.1002/jocb.597

González-Zamar, M. D., & Abad-Segura, E. (2020). Implications of virtual reality in arts education: Research analysis in the context of higher education.

Education Sciences, 10(9), Article 225. https://doi.org/10.3390/educsci10090225

Habib, S., Vogel, T., Anli, X., & Thorne, E. (2024). How does generative artificial intelligence impact student creativity? *Journal of Creativity*, 34(1), 100072. https://doi.org/10.1016/j.yjoc.2023.100072

Hamilton, S. (2019) Reflection(s) In/On Digital Writing's Hybrid Pedagogy, 2010–2017, *Computers and Composition*, 52,158-174. https://doi.org/10.1016/j.compcom.2019.02.006 .

Hernández, R., Fernández, C., & Baptista, M. P. (2010). *Metodología de la Investigación*. McGraw-Hill.

Hong, E., Hartzell, S.A., & Greene, M.T. (2011). Fostering Creativity in the Classroom: Effects of Teachers' Epistemological Beliefs, Motivation, and Goal Orientation. *The Journal of Creative Behavior*, 43(3), 192-208. https://doi.org/10.1002/j.2162-6057.2009.tb01314.x

Huang, S. Y., Ko, P. J., Lin, H. H., Dai, R. H., & Chen, H. C. (2021). Creative thinking counseling teaching program can improve the creativity, creative tendency, and self-concept of grade 7 students: a quasi-experimental study. *The Journal of Creative Behavior, 55*(3), 819-838. https://doi.org/10.1002/jocb.491

Kaufman, J. C., & Sternberg, R. J. (Eds.). (2019). *The Cambridge Handbook of Creativity*. Cambridge University Press.

Kaufman, J.C. (2012). Counting the muses: development of the Kaufman Domains of Creativity Scale (K-DOCS). *Psychology of Aesthetics, Creativity, and the Arts*, *6,* 298-308. https://doi.org/ 10.1037/a0029751

Kaufman, J.C., & Beghetto , R.A. (2009). Beyond big and little: The four c model of creativity. *Review of General Psychology*, *13* (1), 1-12. https://doi.org/10.1037/a0013688

Koivisto, M., & Grassini, S. (2023). Best humans still outperform artificial intelligence in a creative divergent thinking task. *Scientific Reports, 13*(1), Article 13601. https://doi.org/10.1038/s41598-023-40858-3

Lee, J.H. & Portillo, M. (2022) Transferability of creative self-belief across domains: The differential effects of a creativity course for university students, *Thinking Skills and Creativity*, 43,100996. https://doi.org/10.1016/j.tsc.2021.100996 .

Lemons, G. (2010). Bar drinks, rugas , and gay pride parades: Is creative behavior a function of creative self-efficacy? *Creativity Research Journal*, 22, 151-161.

Li, R. (2024) A "Dance of storytelling": Dissonances between substance and style in collaborative storytelling with AI, *Computers and Composition*, 71. https://doi.org/10.1016/j.compcom.2024.102825 .

LOMLOE (2020). Organic Law 3/2020, of December 29, which modifies Organic Law 2/2006, of May 3, on Education. Recovered from: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2020-17264

Long, H., & Wang, J. (2022*). Dissecting reliability and validity evidence of subjective creativity assessment: A literature review*. Educational psychology review, *34*(3), 1399-1443. https://doi.org/10.1007/s10648-022-09679-0

Martín-Ezpeleta, A., Saneleuterio, E., Mínguez-López, X. & Echegoyen-Sanz, Y. (2024). Generation of creative metaphors and perception of creativity of future teachers. *Revista Complutense de Educación,* in press.

Merrotsy, P. (2013). A note on big-C creativity and little-C creativity. *Creativity Research Journal, 25* (4), 474-476. https://doi.org/10.1080/10400419.2013.843921

Mishra, P., & Henriksen, D. (2024). *Creative Dialogue with Generative AI: Exploring the Possible with Ron Beghetto.* TechTrends. https://doi.org/10.1007/s11528-024-00949-y

Newton, D.P. (2013). Moods, emotions and creative thinking: A framework for teaching. *thinking Skills and Creativity,* 8, 34-44. https://doi.org/10.1016/j.tsc.2012.05.006

Ng, D. T. K., Lee, M., Tan, R. J. Y., Hu, X., Downie, J. S., & Chu, S. K. W. (2023). A review of AI teaching and learning from 2000 to 2020. *Education and Information Technologies, 28*(7), 8445-8501. https://doi.org/10.1007/s10639-022-11491-w

OECD (2019). *PISA 2021 creative thinking framework (third draft)*. OECD publishing. Retrieved from: https://www.oecd.org/pisa/innovation/creative-thinking/

OECD (2021). *OECD Digital Education Outlook 2021: Pushing the frontiers with artificial intelligence, blockchain and robots*. https://doi.org/10.1787/589b283f-en

Patston, T.J., Kaufman, J.C., Cropley, A.J., & Marrone, R. (2021). What Is Creativity in Education? A Qualitative Study of International Curricula. *Journal of Advanced Academics*, 32(2), 207–230. https://doi.org/10.1177/1932202X20978356

Peinado, F., Francisco, V., Herva's, R., & Gerva's, P. (2010). Assessing the Novelty of Computer-Generated Narratives Using Empirical Metrics. *Minds & Machines, 20*, 565-588. https://doi.org/10.1007/s11023-010-9209-8

Petersen, D. B., Gillam, S. L., & Gillam, R. B. (2008). Emerging procedures in narrative assessment: The index of narrative complexity. *Topics in language disorders, 28*(2), 115-130. https://doi.org/10.1097/01.TLD.0000318933.46925.86

Robin, B. R. (2016). The power of digital storytelling to support teaching and learning. *Digital Education Review, 30*, 17–29.

Runco, M.A., & Bahleda , M.D. (1986). Implicit theories of artistic, scientific, and everyday creativity. *The Journal of Creative Behavior*, *20* (2), 93-98. https://doi.org/10.1002/j.2162-6057.1986.tb00423.x

Sawyer, R. K., & Henriksen, D. (2024). *Explaining creativity: The science of human innovation*. Oxford University Press.

Tackvic, C. (2012). Digital Storytelling: Using Technology to Spark Creativity. *Educational Forum*, 76(4), 426-429. https://doi.org/10.1080/00131725.2012.707562

Tang, C.Y., Mao, S.B., Naumann, S.E., & Xing, Z.W. (2022). Improving student creativity through digital technology products: A literature review. *Thinking Skills and Creativity,* 44, 101032. https://doi.org/10.1016/j.tsc.2022.101032

Tsao, J., & Nogues, C. (2024). Beyond the author: Artificial Intelligence, creative writing and intellectual emancipation. *Poetics*, 102, 101865. https://doi.org/10.1016/j.poetic.2024.101865

Urban, M., Dechterenko , F., Lukavsky , J., Hrabalová , V., Svacha , F., Brom , C., & Urban, K. (2023). ChatGPT Improves Creative Problem-Solving Performance in University Students: An Experimental Study. https://doi.org/10.31234/osf.io/9z2tc

Vaquero, A. F. G., & Diaz, M. A. (2023). Exploring Tolkien's Literary Universe in the EFL classroom. Approaching Literature through Robotics-enhanced Inquiry-based learning. *Digital Education Review, 44*, 1-12. https://doi.org/10.1344/der.2023.44.1-12

Vicente-Yagüe-Jara, MI, López-Martínez, O., Navarro-Navarro, V., & Cuéllar-Santiago, F. (2023). Writing, creativity, and artificial intelligence. ChatGPT in the university context. [Writing, creativity and artificial intelligence. ChatGPT in the university context]. *Communicate, 77*, 47-57. https://doi.org/10.3916/C77-2023-04

Walsh, C.S., Craft, A., & Koulouris, P. (2014). Gameful Learning Design to Foster Co-Creativity? In *International Conference of the Australian Association for Research in Education (AARE)*. Freemantle, Australia. Retrieved from https://www.aare.edu.au/data/2014_Conference/Full_papers/Walsh_14_.pdf

Weder, F., Lemke, S., & Tungarat, A. (2019). (Re)storying sustainability: The use of story cubes in narrative inquiries to understand individual perceptions of sustainability. *Sustainability, 11*(19), Article 5264. https://doi.org/10.3390/su11195264

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

Yates, E. & Twigg, E. (2017). Developing Creativity in Early Childhood Studies Students. *Thinking Skills and Creativity*, 23, 42-57.

Yilmaz, R. M., & Goktas, Y. (2017). Using Augmented Reality Techology in Storytelling Activities: Examining Elementary Students' Narrative Skill and Creativity. *Virtual Reality, 21*, 75-89. https://doi.org/10.1007/s10055-016-0300-1

Zimmerman, M. (2018). *Teaching AI: Exploring new frontiers for learning*. International Society for Technology in Education.

CREATIVITAT I INTEL·LIGÈNCIA ARTIFICIAL: UN CAS D'ESTUDI AMB FUTURS MESTRES

La intel·ligència artificial (IA) proporciona enormes oportunitats als processos d'aprenentatge, ensenyament i avaluació. Entre ells, és essencial explorar la seva capacitat per canalitzar la creativitat dels estudiants, que es descriu com una competència clau en la formació de persones, que segons l'OCDE i la recent llei LOMLOE espanyola es necessari fomentar en tots els àmbits educatius. En aquest context, l'objectiu d'aquesta investigació és explorar el potencial creatiu dels futurs mestres d'Educació Infantil, relacionats amb la narració de contes, a través d'un projecte que inclou l'ús racional d'eines generatives d'IA. Es va utilitzar una combinació d'instruments qualitatius i quantitatius per obtenir informació sobre les implicacions d'aquestes eines d'IA en el procés creatiu i per comprendre les preocupacions dels futurs mestres sobre aquestes, tant en la seva formació com en la seva futura pràctica docent. Els resultats mostren el potencial de la IA des del punt de vista educatiu, especialment en els processos d'autoavaluació i coavaluació, ja que permet confrontar no només el resultat de la tasca creativa, sinó reflexionar sobre el seu desenvolupament. Es discuteix sobre la importància de continuar la recerca sobre la capacitat de formular qüestions (una habilitat creativa en si mateixa) en el nou context de la IA.

PARAULES CLAU: creativitat, intel·ligència artificial, futurs mestres, narració

CREATIVIDAD Y INTELIGENCIA ARTIFICIAL: UN CASO DE ESTUDIO CON FUTUROS MAESTROS

La inteligencia artificial (IA) proporciona enormes oportunidades en los procesos de enseñanza-aprendizaje y evaluación. Entre ellos, es esencial la canalización de la creatividad de los estudiantes, que se describe con una competencia clave en la formación de personas, que según la OCDE y la reciente LOMLOE española es necesario fomentar en todos los ámbitos educativos. En este contexto, el objeto de esta investigación es explorar el potencial de creación de los futuros maestros de Educación Infantil, relacionados con la narración de cuentos, a través de un proyecto que incluye herramientas generativas de IA. Se utilizó una combinación de instrumentos cualitativos-cuantitativos para obtener información sobre las implicaciones de la IA en el proceso de creación y para comprender las preocupaciones de los futuros maestros sobre ella, tanto en su formación como en su futura práctica docente. Los resultados muestran el potencial educativo de la IA, especialmente en los procesos de autoevaluación y coevaluación, puesto que permite confrontar no solo el resultado de la tarea creativa, sino también la reflexión sobre su desarrollo. Finalmente, se discute acerca de la importancia de la capacidad de plantear cuestiones (una habilidad creativa en si misma) en el nuevo contexto de la IA.

PALABRAS CLAVE: creatividad, inteligencia artificial, futuros maestros, narración

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