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Different Perspectives on Human Creativity and Learning Analytics

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Abstract

Creativity is a thinking ability that enables problem-solving in an innovative manner and produces original and valuable products. In recent years, there has been growing recognition that creativity is an essential skill for the 21st century, and that it can be nurtured; therefore, it is recommended to include creativity in educational curricula from an early age. However, prior studies have differed from each other by their definition of creativity, unit of observation, data collection, and data analysis, among others. Learning Analytics has already played an important role in the extension and expansion of this growing line of research, as it enables new approaches to the study of human creativity in educational contexts. This special section is focused on the unique role that Learning Analytics plays in studying human creativity, drawing on the state-of-the-art in the field, especially to answer: "What is creativity?", "How can it be measured?", and "Why is creativity related to the context we study?".

Keywords: artificial intelligence, automatic analysis, collaborative learning, competencies, computational creativity, computational social science, computational thinking, creativity assessment, creativity, data-driven evaluation, educational contexts, educational data mining, educational technology, game-based assessment, higher education, learning analytics, linguistic creativity, natural language processing, process visualization, robot-guided learning, student log data, Think Pair Share, verbal fluency, writing

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1. Special Section Introduction

Creativity is a thinking ability that enables problem-solving in an innovative manner and produces original and valuable products. It has been identified as crucial to human inventive potential in all disciplines, and its influence dominates various spheres of life. In recent years, there has been growing recognition that creativity is an essential skill for the 21st century, and that it can be nurtured; therefore, it is recommended to include creativity in educational curricula from an early age. International organizations have identified creativity as a core skill to be developed to promote personal growth, lifelong learning, and workmanship (e.g., OECD, 2018; World Economic Forum, 2020), and recent research has supported this notion (Karwowski et al., 2020; Lucas & Venckute, 2020; Rubenstein et al., 2022). Considering its importance, student assessment programs already focus on evaluating creativity (OECD, 2024).

Over the last few decades — especially since the early 2000s — research on creativity in learning and teaching has grown, spanning such areas as teaching and learning of creativity, interconnections between creativity and learning-related variables, influencing factors on creativity, and creativity-supporting learning environments. Within this wide scope, studies have differed in their definitions of creativity, units of observation, data collection methods, and data analysis, among others. Learning analytics has already played a key role in the extension and expansion of this growing line of research, as it enables new approaches to the study of human creativity in educational contexts (Marrone & Cropley, 2022). Computational approaches that have been an integral part of the learning analytics toolset — and new ones that can be suggested — may help assess creativity in unprecedented ways, thus meaningfully enhancing our understanding of creative processes (Chou et al., 2024; Hershkovitz et al., 2019; Kovalkov et al., 2021; Manske & Hoppe, 2014; Theodore et al., 2024). Learning analytics can inform educators and learners about creativity, hence support its improvement, in an ongoing feedback cycle.

This special section focuses on the unique role that learning analytics plays in studying human creativity, drawing on the state-of-the-art in the field. While reading any paper in this area, one must keep three questions in mind: What? How? and Why? First, what is creativity? Creativity has been referred to in many ways and from various perspectives. The two most commonly used taxonomies refer to either the four Ps (place, person, process, product), which position creativity as a resulting outcome, or to the four Cs (big-C, pro-c, little-c, mini-c) that describe a hierarchy of creative products, ranging from everyday learning and local problem-solving to field-defining artistry and invention (Kaufman & Beghetto, 2009; Rhodes, 1961). Within each of these dimensions, a host of more practical definitions may be used to assess creativity. Which leads us to the question How? After choosing a definition, we should ask how creativity can be measured. In the context of learning analytics, this is mostly a matter of operationalization. Lastly — ideally the leading question — we should consider why creativity is related to the context we study. Considering these three questions together, researchers proposed various definitions, conceptualizations, and assessment methods in human creativity (Henriksen et al., 2021; Israel-Fishelson & Hershkovitz, 2022; Lucas & Venckute, 2020). Indeed, each of the papers in this special section — one review paper and five empirical studies — sheds some light on these questions.

A meta view comes in a scoping review of the role of learning analytics in assessing and fostering creativity in educational contexts (Manganello & Fante, 2025). Covering 41 studies (2011–2024), they discuss the creativity of education stakeholders in various educational contexts, from K–12 to higher education, and in different learning environments, where learning analytics has been applied for assessment and fostering. The very number of papers is an indicator of the growth of this field, however their mapping highlights persistent fragmentation vis-à-vis the different theoretical frameworks used. This review also highlights the importance of learning analytics in measuring creativity, with a shift from static to dynamic assessment paradigms, and calls for more sophisticated mechanisms of measurement. It also calls for more research in the non-STEM fields and across competencies, and for more advanced research designs, specifically longitudinal studies.

An interesting analytics approach is presented in Lobo-Quintero (2025), where a commonly used pedagogy, i.e., think-pair-share (TPS; often extended to think-pair-square-share) is augmented with AI to foster linguistic creative thinking. This approach traditionally consists of three (or four) phases: individual thinking, with students reflecting on a question independently; paired discussion, where they exchange ideas with a partner (often with two pairs joining together for further discussion); and group sharing of insights with the entire class. In this research, the pair stage was enhanced with an AI-based chatbot to suggest relevant questions and different perspectives and providing feedback on writing structure and clarity. Measuring linguistics creativity of undergraduate pair conversations was focused on traditional divergent thinking–related indicators, i.e., fluency, flexibility, originality, and elaboration, using different lexical analysis techniques, such as type-token ratio (TTR), measure of textual lexical diversity (MTLD), topic modelling, and similarity analysis. Notably, students in the experimental group demonstrated significant productivity gains, increased thematic diversity, and higher participation rates.

Usher et al. (2025) demonstrates the use of learning analytics to measure creativity in a collaborative setting — a comparative study of the impact of robot-guided and simulation-based collaborative learning on undergraduate students' computational creativity and computational thinking skills. Here too, divergent thinking–related indicators were used to measure group flexibility, originality, and elaboration (with fluency less relevant) in devising block-based programming codes, using log file analysis combined with self-report questionnaires. The findings highlighted that the robot-guided modality offered significant advantages in specific dimensions of computational creativity, particularly elaboration and originality, while flexibility was equally supported by both modalities.

A different approach to measure creativity in a puzzle-based digital learning environment — in the case of elementary school geometry — is presented in Strukova et al. (2025). Here, human coders labelled student solutions for fluency, flexibility, and surprise. Ten machine learning classification models — such as random forest, support vector machine, logistic regression, and gradient boosting — were used to predict these measures based on logged data. Findings highlight the advantage of using specific machine learning models over others and emphasize the predictive power of some behavioural aspects within the digital learning environment.

In Flynn and Allen (2025), machine learning models were used to predict human-labelled creative fluency and verbal fluency of undergraduate responses for the alterative uses task and for a writing task, respectivelyClick or tap here to enter text.. Various linguistic features — such as cohesion, syntax, or sentiment — served as the predictors in a few models, both linear and non-linear. Overall, the results suggest that creativity-related measures may be predicted based on computational linguistics and nonlinear modelling techniques. Importantly, differences between predictions of the two modes of creativity are highlighted, as well as between predicting divergent and convergent thinking.

Of course, work with large language models (LLMs) is not absent from this collection. In an interesting study of fourth-grade students who programmed musical flow, ChatGPT-4 was used (with few-shot learning) to assess creativity along four indicators: divergent thinking, complexity, efficiency, and expressiveness (Liu et al., 2025). Additionally, these indicators were measured computationally based on the system log files, taking an evidence-centred design approach. The two sets of measures were triangulated with human labelling. The findings suggest moderate to strong correlations of automated assessments with human evaluations, with the LLM-based approach exhibiting greater consistency across diverse examples. Also, LLM-based methods, trained on human-assessed examples, demonstrate strong alignment with human evaluators, illustrating their capacity to complement and support human judgment in creativity assessment.

Taken together, this special section illustrates a broad view on the current learning analytics research in the field of creativity. In addition to the different topics and the different methodological approaches, we highlight the geographic span — with papers coming from North America (USA), South America (Colombia), Europe (Spain, Italy), and the Middle East (Israel) — and the range of educational contexts, from primary to secondary to higher education. We hope that this special section will enrich the ongoing discourse on creativity and will help advance research in the field, across educational contexts and applications.

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