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Artificial Intelligence, Creative Authorship, and Education in Algorithmic Environments

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Abstract This study aimed at conceptualizing the transformation of creative authorship within algorithmic educational environments, to determine if the distinctive contributions of humans, artificial intelligence (AI), and institutional accountability could be separated analytically in human and AI co-created educational outputs. A documentary content analysis of 30 documents (published or updated between 2023 and 2026) containing academic literature, institutional policy-oriented documents, and analytical reports regarding the role of generative artificial intelligence within education, academic writing, creative learning, assessment, and copyright regulation was conducted. The analysis revealed that the notion of creative authorship does not characterize a completely independent act of authorship on the part of an author nor does it represent an entire substitution of an author by an algorithm; it does exist as a distributed and therefore accountable process that is shaped by human intention, machine-generated support, institutional principles, and the expectations of the assessment process. Five predominant thematic clusters were identified from the 30 documents: pedagogical applications of generative AI; creative cognition and ideation; distributed authorship; academic integrity; and the legal/normative regulation of AI-generated outputs. Eight sources were focused on teaching and eight were focused on evaluating academic writing practices within an academic setting. Seven articles were also analyzed within the framework of academic integrity. Five articles analyzed were concerned with creative cognition; five were based on collaborative processes of authorship; five articles analyzed legal-normative regulation. The results clearly indicate that the majority of sources analysed provide evidence that artificial intelligence works primarily as 1) an educational support system; 2) a partner/co-creator in the learning process; 3) an evaluator for assessing students; and 4) a regulatory body when assessing/validating submitted work. Based on these results, this research recommends that educational institutions no longer simply prohibit artificial intelligence use or seek to identify it within student work and instead focus on developing new forms of assessment that reflect human contribution, revision, responsibility, and originality within algorithmic learning environments.

Index Terms media communications, media text, classical music, performance art, AI interactivity, digital public relations, academic art, audience

1. Introduction

This study focuses on the challenges posed by the fast-paced integration of generative artificial intelligence into education and creativity, as the line between human authorship, algorithmic aid, and institutional accountability has continued to blur. In algorithm-driven learning environments, students and teachers have begun using generative AI not just as a tool but also as an equal collaborator whose contribution affects how ideas, written works, mentoring/feedback, and learning paths are created. This blurring of the lines raises many questions regarding the definition of creative contribution and the parameters of academic integrity and the legitimacy of authorship when academic products are designed through human-AI collaboration.

Contemporary scholarship considers generative artificial

intelligence as being a more than just a support for learning; rather, it alters the conditions through which learning, creativity and authorship happen within educational environments [1], [2]. Giannakos et al. [3] said that generative artificial intelligence provides additional means for creating personalised experiences, giving feedback, and designing learning; however, the integration of generative artificial intelligence into educational settings has remained methodologically and morally unstable due to the fact that institutions do not typically have established criteria or guidelines for using these technologies responsibly. This overarching uncertainty surrounding the use of generative artificial intelligence is intertwined with the issue of creative authorship [4]. Creely and Blannin [5] suggested that rather than acting simply as in-

struments of technical ability, generative artificial intelligence can serve also to enhance the ways in which an individual develops their creativity by acting as a designer. This may lead to a shift in the individual's role as a producer of creative work to that of an active participant in co-creating with others through generative artificial intelligence, a shift also noted by Nguyen et al. [6]. Academic writing is becoming increasingly collaborative between students and AI systems, which complicates distinguishing between students' original contributions and AI-assisted ones. Bittle and El-Gayar [7] also observe that higher education still lacks a consistent way to distinguish between acceptable assistance from others and fraudulent authorship, indicating that generative AI is producing significant changes related to academic integrity. Alternatively, Al-Busaidi et al. [8] highlight legal and conceptual dimensions of this challenge; they show that generative AI is changing the definition of copyrights, ownership of intellectual property, and ownership of knowledge. Taken together as a set of studies, they indicate that there is a body of literature that includes discussions about generative artificial intelligence in education (including creativity), academic writing and integrity, and copyright law. However, these aspects have been addressed independently of one another. The other gap that needs to be completed is an analytical framework connecting educational practice, creative authorship, and algorithmic environments; this framework explains how authorship is redistributed when learning and creative production happen (through interacting with an AI).

Despite a considerable amount of research into generative artificial intelligence in education, creativity, academic writing, scholarly integrity, and copyright, the various branches of these areas have not been brought together into a common unifying framework. The majority of existing literature has focused on either the potential for using artificial intelligence as an educational tool, the risk of integrity issues associated with its use, or the legal ambiguity surrounding the use of AI-generated output. However, little work has focused on how creative authorship is being reallocated amongst all parties involved within an algorithmically driven educational system. As such, an unexplored void exists in that there has yet to be a cohesive framework developed to analyze the interaction of human intent, machine-generated contribution, and educational accountability when creativity is produced through a collaborative partnership between humans and artificial intelligence.

The purpose of this research is to understand how algorithms have changed the definition of creative authorship in education, as well as how we can differentiate between human input, machine input through artificial intelligence and the accountability of institutions when looking at joint products (educational outputs) between humans and AI. The first focus of the research is to clarify the relationship between generative AI, creative authorship and educational practice, while the second focus is to identify the main types of collaboration between humans and AI in both academic and creative settings. Subsequently, the research will analyze the influence

of algorithmic tools on originality, agency and academic integrity; and finally, the researchers will create an analytical framework for viewing authorship as a distributed activity that results from both human intention and machine-generated contributions.

II. Literature Review

There are three distinct but related areas of research on artificial intelligence and education—how creativity will change with generative AI; how authorship will change with human–computer collaboration; and how algorithms will impact educational institutions. Each of these areas is significant analytically because we are no longer viewing algorithmic tools just as digital infrastructures for delivering content; we now see they also produce content in the form of written text, images, feedback, evaluation, and creative decisions. Therefore, the traditional separation of learner as author, teacher as evaluator, and tool as a neutral tool is increasingly unstable.

There has been an extensive focus in the scholarly community in recent years on whether or not generative artificial intelligence enhances or diminishes human creativity. For example, Haase and Hanel [9] concluded that generative artificial intelligence chatbots were able to produce creative output at levels comparable to that of humans in some tasks. This finding supports the shift away from older assumptions regarding creativity being an entirely 'human' cognitive skill; however, it leaves a significant question about evaluating student creativity in classrooms. If algorithmic systems can rapidly generate creative alternatives, then assessments of the creativity of student work must not only rely upon the novelty/fluency of the result, but also evaluate the creative process through which the product was produced. Habib et al. [10] furthered this discussion in an educational context by studying the impact of generative artificial intelligences on student creativity. The work they have done is beneficial because rather than focusing on theoretical ideas of creativity in AI programming, their focus is on the actual experiences of students. However, one of the limitations within this area of research, is that while creativity is typically assessed as an end result, the underlying issue related to authorship, accountability and intellectual ownership has not been addressed adequately.

Additional evidence regarding the debate about generative text AI and its ability to assist in design creativity research has been introduced through a study by Georgieva and Georgiev [11]. Their research showed that AI could facilitate activities such as ideation, reframing alternative solutions, etc. In addition, Hwang and Wu [12] further specified the manner in which generative AI affects the cognitive processes of design students regarding their creative self-efficacy and related anxieties. These two studies offer useful evidence because they highlight that the impact of AI on creativity will not be uniformly for all students; for example, some may have an increased level of confidence or broader ideation possibilities through using AI, while others may have heightened levels of dependence, uncertainty, and anxiety when they cannot

accurately determine if the outcome of their creative process was produced by them or developed by the AI system. The challenge with the remaining body of research is that it primarily isolates the cognitive and/or psychological process of the student within the human-AI interaction, while not considering the educational implications of authorship.

Research has focused more exclusively on the issue of authorship in the context of artificial intelligence arts and creative labour. In his article Goodfellow [13], suggested the concept of distributed authorship in an era of AI-produced creativity thereby showing how much of the creativity today derives from the combination of human intention, datasets, algorithmic architectures, prompts, and platform constraints. This is of particular interest to the field of education, as the creative products of student work produced in algorithmic systems are going to continue to be distributed among multiple human and non-human agencies. In their article, Bomba and De Angeli [14] extend this to agency and authorship in AI art and identify how the epistemic issues associated with AI art are related to agency and authorship and how AI art shifts the way we think about knowledge, intent, and creative control. These studies show (1) that AI art produces legal ambiguities for the markets associated with AI art production, and (2) that this reconfiguration of knowledge, intent, and creative control will require a reconfiguration of how we understand learning environments, academic writing, and assessment as these will now be created in systems that are distributed across many agents, both human and non-human.

The labour aspect of generative AI has been developed from a sociological perspective [15]–[17]. Bender [15] argued that generative AI programs may result in the loss of human creativity within the media industry. The addition of this perspective adds a measurement to the current utilitarian debate surrounding whether generative AI will actually replace creative professionals or diminish their collective value. Within an educational environment, students may be using generative AI to produce work faster, diminishing the value of slow creative processes like revisions, failures and individual experimentation. Bender's examination of generative AI is therefore vital to exploring creative authorship not only as a legal or cognitive issue, but also as a source of labour. The pressure to write about how AI will displace writers may also cause us to underestimate some situations where learners have used AI as a tool for learning, thinking about their learning, and extending their creativity as much as they might have done without AI. The tension created by this possibility is a key element of the current research: AI is both a threat to human authorship and a neutral educational tool for assisting individuals.

The second area of research has examined the impact of generative artificial intelligence on higher education institutions [18]. Lee et al. [19] completed an analysis of educator perceptions of the effects of generative AI on learning and teaching. Their data show that while many teachers believe that AI has great potential for use in teaching and learning, they are beset by uncertainties and difficulties related to

unclear policy expectations, the need for redesigning assessments, and uncertainties regarding appropriate usage. Jones-Jang et al. [20] added a dimension to this by looking at how perceptions of fairness in AI algorithmically-based grading systems. Their findings indicate that the use of algorithmic decision-making in education has implications for learning practices and for trust and legitimacy; and, therefore, how fairly any particular student is treated. The implications are particularly relevant because AI in educational contexts could work to create a student's learning experience and their evaluation of it. At present, the ambiguous relationship between the same technologies being both supportive creative partners for students and regulatory tools for institutions has fostered an environment where there will be conflicts among these three categories.

Literature presents a central concern with academic integrity. Karkoulia et al. [21] explored perceptions of academic integrity in higher education associated with ChatGPT and found that ambiguity resulted in attitudes of both students and educators toward ChatGPT versus no attitude (i.e., neither approval nor disapproval). This is important as integrity issues arise from more than just intentional cheating. Integrity issues also arise through creating ambiguity between editing, brainstorming, translating, structuring, paraphrasing, and generating content. Slimi [22] conducted a systematic review of the literature concerning the impact of generative AI on authorship, pedagogy, and academic integrity and identified rapid growth in the literature; however, the literature remains conceptually fragmented. This systematic review connected authorship, pedagogy, and academic integrity within one body of literature. However, there remains a need for a more explicit framework to characterize how authorship, pedagogy, and academic integrity intersect within concrete algorithmic educational contexts.

In copyright and associated legal/ normative literature, the author focuses on copyright and ownership as they relate to the level of human authorship associated with works of art. Samuelson's [23] article presents an examination of the interface between generative AI and copyright law, and he demonstrates that AI-generated works are challenging pre-existing ideas about originality, the nature of training data, and what expression can be protected. Ramos-Zaga's [24] contribution builds on this discussion by providing a normative framework for establishing copyright thresholds within the context of generative AI. He identifies the significance of this issue as determining how much human involvement must occur before authorship is recognized. Lima, et al. [25] add an empirical perspective to this discussion by examining public opinion regarding copyright protection of AI-generated art. They demonstrate that people's attitudes toward copyright are shaped by their experiences, competitive environments, and egocentric views of their world. These studies will have relevance to educators as student products created with AI have the same potential issues around attribution, originality, and legitimate contribution as the generative AI outputs identified above. However, the information derived from copyright-

centric studies does not fully address the educational element of the problem. Research papers don't constitute "same" papers; however, the institution has an obligation to verify if the paper exhibits the student's learning, effort and ability to independently create it, even if the student does not have any legal rights to it because of copyright law.

Of the literature examined, it is clear that generative AI has been researched in relation to its potential to serve as a creative tool, collaborator, potential competitor to human workers, educational technology, integrity issue and copyright infringer. Unfortunately, the literature on these issues tends to remain somewhat siloed from each other – creativity researchers generally study ideas and the cognition behind them; authorship researchers generally look at art and/or copyright; and educators often study how to teach, assess and create policies to ensure integrity in educational systems. Therefore, there is no well-developed comprehensive explanation of how creative authorship is being shared and spread across the various algorithm-based education settings, where human intention, machine generated contributions, institutional norms and evaluative methods are all operating together. The gap in the literature suggests that we need a new way of conceptualizing authorship in educational contexts as not just individual acts or automated processes; rather, authorship is distributed and accountable forms of humans and machines producing things together.

III. Materials and Methods

This was a qualitative, documentary analysis performed in a desk-based setting. The purpose of this study was to look at how creativity is defined, examined, and regulated in relation to authorship within an algorithmic educational environment. Since this article did not require collecting data from students or teachers, the design chosen for this study was a structured examination of already available analytical, academic, and institutional documentation of the changing nature of authorship due to generative artificial intelligence.

The research spanned from 2023 to 2026. The starting point of 2023 was used as many generative artificial intelligence tools were implemented at a high rate within colleges and universities during this time period; with generative artificial intelligence affecting Academic Writing, Creative Learning, and Assessment activities. There were 30 items included in the analytical corpus that were published between 2023 and 2026, which included 24 peer-reviewed Academic Journal Articles/Peer-Reviewed Systematic Literature Reviews, 3 Conference Presentations/Proceedings, 2 Institutional Documents, and 1 Policy-Oriented Report. The corpus was created using a purposive search technique with the databases: Scopus, Web of Science, ScienceDirect, SpringerLink, Taylor and Francis Online, Association for Computing Machinery Digital Library, and Google Scholar, as well as searching with the following keyword combinations "generative AI in education", "creative authorship", "AI-assisted writing", "human-AI Collaboration", "algorithmic learning environments", "academic integrity and chatgpt", "AI-generated art and copyright", and

"AI creativity in higher education".

To be eligible inclusion in this study, an article must meet the following criteria: published in English; published from 2023-2026; have a direct connection to GPT; have an educational, artistic, legal, ethical and/or something to do with authorship; and has enough content for analysis that will be used for qualitative coding. Articles will be excluded from this study if it is a general discussion regarding AI (i.e., tech trends), if they do not focus on an actual generative model, and if they do not directly relate to education or creating works of art. Bibliographic entries must be available in their full form. Journals labelled as 'journalism' that have no academic/institutional analysis are not considered a part of the study.

Four distinct phases were used to analyze the document. First, all document was analyzed to see if it related to the key topic (redistribution of creative authorship in algorithmic-based educational settings). The second phase of the analysis grouped the materials into 5 thematic areas (1. Pedagogical use of generative artificial intelligence, 2. Creative cognition and invention, 3. Divided authorship, 4. Academic integrity, and 5. Legal-normative regulation of AI-generated content). The third phase of the analysis involved coding the source materials in 3 ways (1. The role assigned to AI, 2. The type of human contribution to creativity, and 3. Institutional issues associated with authorship or responsibility). The final phase compared the coded materials from across the thematic groups to identify recurring patterns, contradictions, and underdeveloped intersections between education, authorship, and algorithmic mediation.

This research presented the basis for the development of a coding framework created specifically to classify artificial intelligence (AI) based on its functions: technical tool, learning facilitator, collaboration partner, evaluator, and regulatory actor. Human authorship was categorized into independent authorship, AI-assisted authorship, collaborative authorship, and diminished authorship. Institutional issues affecting academic integrity were classified as uncertain integrity issues, ambiguous grading issues, criteria for originality absent, uncertain copyright, and decreased visibility of student effort. All materials were coded using the same coding schemes, even though many materials could have been rated in more than one category; therefore, re-evaluating borderline cases for accuracy was done after the initial coding stage.

Microsoft Excel has provided an organizational tool to create a coding matrix and compare the frequency with which thematic patterns recur. Because there is no experiment or numerical primary data, no inferential statistical tests were performed for analysis. This allowed for examination of the problem of creative authorship at the intersection of human-created education, algorithmic mediation and regulation, and human-AI co-production, as it exists in actual practice.

IV. Results

In the documentary analysis of 30 sources released between 2023 and 2026, the research demonstrated that creative au-

thorship within an algorithm-based educational setting has not been conceptualized as an individual stable act. The authorship appears as a negotiated process requiring acceptable institutional sensitivity for all involved where human intention, AI-generated assistance, education assessment, and normative accountability are repeatedly connected in some way amongst others. Only the most representative sources will be provided as citations below; however, the coding matrix was created based on the entire sample corpus; this will consist of the 30 sources described within the materials and methods section.

A coding matrix allowed for the identification of five thematic areas which included a pedagogical use of Generative AI within learning, the creative cognition and ideation process, distributed authorship, academic integrity, and legal and/or normative regulations regarding AI generated outputs. The five thematic areas did not function as disparate entities but rather were represented in three phases of transformation; the first phase saw Generative AI used as a learning and productivity tool within the educational sector. The second phase saw Generative AI as a co-creator in producing text and ideas. Finally, the third phase put pressure on institutions to redefine originality, integrity, responsibility, and copyrightability.

Analytical indicator 1 related to the role given to artificial intelligence; the coding of responses indicated that artificial intelligence is most frequently seen as learning aids and co-creators, and least frequently seen as technical tools. Many institutional and policy-based responsiveness provided an analysis of how artificial intelligence should be governed, reported on, and assessed. For example, UNESCO provided guidance on using generative AI to support learning and research; an age-related, ethical, and institutional framework must be in place for use with generative AI. Similarly, Jisc [26] positioned artificial intelligence in tertiary education as a technology to support teaching, assessing, and institution adapting, but with some responsibility for the institution. This evidence suggests that algorithmic educational environments are being normalized as part of the educational infrastructure.

The second analytical indicator focused on the various types of human creativity contributions. According to the corpus, the independent production of the original conceptual model is no longer prevalent in the materials being developed about AI-assisted learning or writing processes. Instead, the most commonly used creative production model is that of AI-assisted production and the user's ability as a student or researcher to produce original work; specifically, an AI system will provide assistance with drafting, rewording, brainstorming, clarifying, or organizing an idea while the user completes all aspects of the project including setting the initial intent and objectives, carrying out all projects in accordance with academic integrity, and being accountable for their own work; thus reinforcing the original creative production model. Reports focused on student experiences will further corroborate this phenomenon, as the Digital Education Council [27], Freeman [28], and Freeman [29] found that many students started encountering AI tools through generative AI as part of their day-to-day study habits, while institutions have been

attempting to define a suitable measure of when AI can be used as a legitimate tool to assist a student and when it becomes an academic integrity violation. Therefore, a consistent connection has been developed between AI-supported production (both by the user and by an AI system) and the ambiguous nature of academic integrity in the coding matrix.

The Institutional Problems Analytica Indicator three focused on the issues of authorship and responsibility. There are many visibility problems related to Academic Integrity and Assessment. The institutional documentation failed to classify the use of AI as prohibited for all education. Rather, they attempted to differentiate between allowed forms of support from prohibited forms of substitution. The work done by McDonald et al. [30] was illustrative of this as they conducted an analysis of institutional policy and guidance documents in the field of Higher Education; what these analyses demonstrated was that Higher Education Institutions were moving away from a prohibition-only model to a disclosure model, acceptable-use rules, and redesigning assessments to define AI's role in education. The University of Hong Kong's policy also identified AI as a regulated educational practice and therefore indicated that there should be clarity regarding AI-related transparency, clarity in course expectations, and responsible use of AI in the student population [31]. Therefore, the documentary analysis did not provide an answer to the grand institutional question of whether AI belongs in education, but rather indicated that the grand institutional question is about how we will clarify authorship and responsibility when AI is involved in the production of education. Distribution of dominant coded patterns in the documentary corpus is given in Table 1.

Sources in this cluster primarily portrayed the use of artificial intelligence as a means to support learners through the provision of tools for learning and teaching. Because many of the sources reviewed were educational publications and governmental or other reports related to education policy, sources tended to describe the impact of educational use of AI on learning, teaching, assessing and providing support to students as their largest area of interest in the corpus studied. In fact, the majority of coded material in this cluster focused primarily on the support of learners' creative productions when working with AI. Therefore, the AI-generated content did not replace the role of the learner in the production of creative works; rather, AI was used to enhance or mediate the learner's ability to produce creative works through suggestions to help with the processes of learning. Jisc [26] and Miao and Holmes [32] agree on their recommendation that educational institutions provide guidelines and programs for the appropriate usage of AI by creating an integrated approach to the development and utilization of AI in education (i.e., as an established component within the framework of education) rather than viewing AI as disruptive technologies entering the educational setting. This, therefore, suggests that algorithmic-based AI infrastructures will be integrated into existing infrastructures within educational institutions. The same cluster has shown that there can be uncertainty in student assessment as well.

Table 1: Distribution of Dominant Coded Patterns in the Documentary Corpus

Thematic cluster	Dominant role assigned to AI	Dominant type of human creative contribution	Main institutional problem	Number of sources with dominant cluster coding
Pedagogical use of generative AI	Learning assistant	AI-supported production	Assessment ambiguity	8
Creative cognition and ideation	Co-creative partner	Shared production	Loss of originality criteria	5
Distributed authorship	Co-creative partner	Shared production	Reduced visibility of student effort	5
Academic integrity	Regulatory actor	AI-supported production	Academic integrity uncertainty	7
Legal-normative regulation of AI-generated outputs	Regulatory actor	Weakened authorship	Copyright uncertainty	5

Note: Each source was assigned to the cluster that represented its dominant analytical focus; overlapping themes were considered during cross-cluster interpretation. The table reflects qualitative coding of 30 documentary sources according to three analytical indicators: the role assigned to AI, the type of human creative contribution, and the institutional problem related to authorship or responsibility.

Source: Compiled by the author based on the documentary analysis of sources published in 2023-2026.

If AI can help me with my plan, draft, edit and explain then I'll probably not be able understand an assignment because it was assigned to me using something completely different than what I know to do independently.

The second cluster, creative thinking and idea generation, had a more complex comparison. Within the creative cognition category of this project, AI was referenced more often as a co-creative partner than simply for either correcting grammar or finding information on the internet. The reviewed materials demonstrate that generative AI has the potential to change the trajectory of ideas, the structure of arguments, and the number of creative alternatives available to the student. Within this cluster, there are more examples of collaborative productions versus individual productions. This finding coincides with the findings of previous studies indicating the ability of generative AI to support idea generation (ideation), creative thinking (creative exploration) and design-oriented thinking; however, it also alters the way in which students view their role as an author and their sense of control over the outcome [10]–[12]. According to Haase and Hanel [9], GBots can also have high levels of creativity for particular tasks, which shifts our assessment of creativity as being more process-visible than simply based upon quality of the final output. One issue found in the coding was that the originality criteria were no longer meet. Therefore, because an educational product is an end-result of iterative dance(s) with AI, we can no longer measure the originality of a textual or idea product solely on whether it is novel but also how much the student contributed through prompting, critical selections, revisions and contextual judgments.

The third cluster of distributed authorship mirrored the main topic of the research study. Distributed authorship emerged as a creative act where humans intend to produce something, but they do so in collaboration with AI-generated language, based on rules established by an institution and operating under the constraints imposed by the technology they are using. Shared production was the most frequently applied code in this cluster of data, which aligns with past research that defined creative production as a type of distributively authored output, generated through a combination of human intention, AI-generated output, data sets, prompts, and platform-driven constraints [13], [14]. Nevertheless, despite the alternative interpretations of the way in which documen-

tary sources assign different levels of creative agency to the person using an AI tool, the lack of consensus about creative authorship left the entire concept of creative authorship unclear. AI tool users have different amounts of creative agency depending on how their documentary sources define their role in the creation of the document being created. Consequently, documentary sources assign the person using the AI tool different levels of creative authorship and creative agency. Some sources portray AI as a relatively advanced form of existential support; while others suggest it can dramatically impact the ultimate product of the document created by a human user. With regards to doctoral level education, Molinari et al. [33] further stated that due to the nature of using AI in research environments, researchers must be mindful of authorship, transparency, and academic integrity in their research practice. This is important to the current examination of the situation since doctoral programs have a great deal of significance and importance placed on the difference between providing assistance versus providing an intellectual contribution to the learning process. The problem that exists within this cluster of institutions is that there is limited visibility of either a student's or a researcher's contribution to their work. With the participation of AI when forming ideas or creating text, the final product will not show the distribution of work between a human creative contributor and an algorithmic creator.

The fourth cluster which covered academic integrity was very much related to the other clusters but was more regulatory in orientation than the others. In this particular cluster, an institution's use of AI-related regulations, rules about disclosure, and policies on assessment to define acceptable vs. unacceptable student practices demonstrates that AI is primarily coded as a regulatory actor. While AI did show up in some of the assessment documentation as an evaluator role (or role of AI in assessing or evaluating students), regulatory role played by institutions was the dominant use of AI in this particular instance. According to Freeman [28], students' perspective of generative AI in higher education is much more complex than a simplistic demand for permission or punishment. Additionally, Freeman [29] states there is a growing body of evidence to indicate that the engagement of students with generative AI has become an ongoing concern for higher education institutions rather than a one-off reaction towards a new type of technology. The Digital Education Council [27]

also identifies student use of AI as a global higher education concern and advises that institutions must view student use of AI through the lens of institutional policy, rather than isolated incident(s) of student misconduct (individual incidents of student misconduct which are now being classified as academic integrity violations). When it comes to documentary coding, the academic integrity uncertainty has come from not being able to differentiate between the various levels of human involvement in the creation of AI-generated content (e.g., brainstorming, editing, paraphrasing, generation). Institutions could not define what constitutes 'meaningful' human authorship, so could not create rules to effectively regulate the behaviour of users or those who misused AI-generated content.

Cluster 5 (Legal Normative Regulation of AI Generated Outputs) illustrates that educational authorship cannot be separated from more general questions of: Copyrightability; Copyrightable subject matter (i.e. type of work) and Normative recognition (i.e. legal protections), as the U.S. Copyright Office will continue to stress that copyrightability is dependent on there being a human author and therefore questions around whether and/or where human creative control of AI produced materials can be found are central to their Copyrighting AI Project [34]. In the coding matrix, this source was associated with the Regulatory Actor role and Copyright Uncertainty. The dominant code of authorship within this cluster was Weak Authors, as legal normative materials have historically treated AI-generated outputs as problematic unless human creative control has been made distinctly identifiable. Cooperative creation and production were observed only when there was sufficiently visible human creative control (e.g., through the processes of selecting, arranging, modifying, or otherwise delivering content). A particular implication for education was that educational institutions must evaluate whether AI-assisted works show student learning, creativity, and accountability regardless of whether the legal system recognizes AI-generated content as having protectable human authorship. Thus, while the concept of authorship under copyright law and academic authorship have some overlap, they do not equate. Copyright regulations address protected works of expression, while educational evaluation looks for evidence of learning and accountable intellectual work.

The cross-cluster analysis identified three main trends. First, AI-enabled production was the most consistent as an intermediate level or category between independent productions and diminished individual authorship; this is evident by the prevalence of AI-enabled content in private sector production resources, education (such as teaching), student usage, higher education writing resources, as well as resources that are concerned with policy. As such, the documentary evidence does not support a binary view of the authorship situation as being either "human" created works or "AI" created works. Rather, the majority of sources offer an intermediate state of human authorship still being a component but needing to be disclosed, reported, and evaluated in a different manner.

Creative authorship in algorithmic environments is not

merely due to delegation or automation - there is evidence of shared production across clusters such as creativity, ideation, and distributed authorship. An understanding of how the various creative functions are redistributed shows that while the AI produces the alternatives, formulations and architectures, the human contributor selects, modifies, validates and adds context. It becomes more difficult to evaluate the contributions of the students when these functions are redistributed since the AI partners are now equivalently creative. As such, preserving the conventional attributes of originality was increasingly difficult as the AI served in this role of co-creating with the student contributor.

Thirdly, the most visible regulatory entity was the institutional/ legal-normative. TEQSA [35] linked generative AI to academic integrity and reforming assessment, indicating that institutions needed to change how they assess due to the impact of AI rather than just using detection or imposing prohibitive measures. Similarly, McDonald et al. [30] demonstrated that there are more regulations being developed to outline acceptable uses of AIs in higher education policies based on guideline definitions, disclosure expectations and statements of responsibility. Overall, these findings indicate that the educational environment created by algorithms has been influenced by more than just student behaviours and capabilities of an AI; it is also affected by the institutional rules and regulations around the definitions of how an AI is used: whether it is being used as support, collaboration, academic dishonesty or regulated method of learning.

Based on an analysis of 3 different indicators, it can be concluded that the evolution of creative authorship has changed when considering the roles, contributions and responsibilities of authors and their work. The role of AI was coded as a technical tool, therefore human authorship was stable; AI contributes to authorships by way of providing technical support to aid the authors in their creative work (via the usage of their creative outputs). The usage of AI was coded as a learning aide; the process of co-authoring has transitioned from primarily being attributed to the humans who contributed, to also including AI based upon the new requirement that authors be assessed based on defined criteria. The transition toward co-authoring with AI (by virtue of coding AI as a creative co-author) leads to shared authorship between creator and non-creator, and raises issues of what constitutes original work and the visibility of contributor's efforts. The usage of AI as a creative evaluator introduces issues related to the validity of authorship and can be viewed as a form of creative or operational control. In the legal-normative cluster, there is uncertainty regarding the copyright on AI-created outputs (i.e., whether or not they have been created with sufficient human authorial control/processes to constitute copyright).

The findings concluded that creative authorship in algorithmic educational settings is best represented as a distributed and accountable process. It is distributed because educational and creative products are increasingly seen as being produced through collaboration (or in conjunction) with human users, generative AI systems, institutional policies, and normative

expectations. However, it is also accountable because neither educational institutions nor legal systems have recognised that AI participation should completely exonerate a human user's responsibility. Therefore, the documentary corpus supported the claim that the primary challenge with AI-generated works is not that they will replace human-generated works, but that there will be an ongoing need to make human contribution visible, measurable, and normatively impactful as a result of collaborative or co-generated (algorithmically) processes.

V. Discussion

The findings from the documentary analysis suggest that creative authorship (using algorithms as part of educational environments) is not determined solely by human creation or complete replacement with an algorithm. The coded corpus reflected an intermediate situation where generative AI typically acted as a learning support tool (or co-creator), while people's authorship continued to depend on intention, choice, modification and accountability for the end product. This result is significant because it moves from asking if AI should be permitted in education to how human contributions can be identified and evaluated if education-related products are developed collaboratively with AI.

Urmeneta and Romero [36] partially echo this interpretation by defining AI as a creative collaborator who can help learners create. The results of this current research affirm this perspective since creative cognition and distributed authorship cluster data show that AI can broaden the horizon of options and potential forms available to learners. In contrast to creative-oriented assessment, however, this current documentation linked co-creation to institutional challenges regarding authenticity, evaluation, and students' visibility of contributions. Thus, this interpretation suggests that AI-supported creativity should be seen as both an educational opportunity and a challenge related to responsible authorship.

Results from the current study corroborate the dual viewpoints posited by Wang et al. [37] regarding the technological advantages and disadvantages of using generative AI in education. More specifically, AI-assisted creation was found to enhance access to feedback [38], design, and text creation while, simultaneously, the enhancements provided through the use of generative AI could make it very difficult to determine assessment accuracy because the final outcome does not necessarily reflect the independent knowledge and/or creation of the student. Therefore, while AI-assisted creation has monetary benefits, the educational value that an institution attaches to the ability of its generative AI platform to be productive also may influence how well the institution can establish the standards for creating acceptable types of assistance.

The Wang et al. [39] research highlighted a comparable finding from their empirical study of generative AI in pedagogy. Their analysis indicated the increasing integration of generative AI into teaching and learning contexts. Our data confirms this trend, particularly in the cluster where AI has been recorded as a learning support. However, this study adds that pedagogical integration of generative AI is inextricably

connected to regulations surrounding authorship. If generative AI is going to be incorporated into everyday learning processes, academic integrity policies will have to differentiate between independent creation, AI-assisted creation, collaboratively created works, and diminished authorship. The governance component identified in the findings of this study aligns with the findings that Wang [40] discussed regarding accountability, justice, and transparency being key barriers to the effectiveness of algorithmic decision-making within education governance. Our findings reinforce Wang's argument that authorship is also part of governance. Not only do the rules set by institutions govern the use of technology, but they also create boundaries around what student work is considered to be original, responsible and academically valid. This is why AI has emerged as a regulatory agent as part of both the academic-ethics cluster and the legal-normative cluster of the general regulatory framework.

These results are partially in line with previous research by Werdiningsih et al. [41] which studied the relationship of balance between the use of AI for assistance in writing compared to authenticity. This investigation supports the belief that using AI in writing does not automatically lead to a lack of authenticity in writing; however, authenticity can only be shown through a demonstration of ongoing transparency throughout the writing process, revision of the original draft through appropriate means, and through evidence of student effort/engagement.

In practice, universities should assess not only the end product created by a student but also how the product was made (e.g., disclosing the use of AI, providing evidence of drafts and revisions, asking students to justify AI-generated suggestions, giving students reflective commentary of their work as well as providing evidence of designing tasks that cannot easily be completed via automated means). These types of activities are not intended to banish AI from education but rather to make the human contributor more recognisable and assessable academically. Therefore, there needs to be a set of standards that will allow for the evaluation of the human component of algorithm-based educational environments in addition to establishing policies regarding the use of AI in education. Lastly, while Creative Authorship can continue to exist when using AI assistance, it must be acknowledged, seen, and assessed accordingly.

The research shows that creative authorship in algorithmic educational environments can be seen as a collaborative (and distributed) but accountable practice. The analysis of 30 documentary sources over the years 2023-2026 highlights that generative AI is mainly thought of as a support or tool to creative authorship, rather than a neutral technical tool. It can also be thought of as an educational assistant, a creative partner, an evaluator, and a regulatory agent, in addition to being an independent technical solution. The analysis identified five primary clusters using generative AI that represent the different pedagogical uses of generative AI, ways in which human cognition and creativity are enhanced through generative AI, the idea of collaborative (distributed)

authorship, issues of academic integrity, and legal-normative regulation of AI-generated outputs. The largest cluster was for the pedagogical uses of generative AI, while the problems of academic integrity and ambiguous evaluation were found to be the most sensitive by institutions. The findings suggest that AI-supported creation has a status that occupies the space between independent creation and diminished authorship, such that human authorship will only be sustained when the learner's intentions in producing, choosing, and judging their work are visible in the final product.

This study has shown that the educational sector should not solely depend on banning or detecting the use of AI. However, they must also implement transparent methods to ensure they provide disclosure of AI assistance, proof of drafts and/or revisions, provide rationale of student decisions and create assessment tasks that reduce the efficacy of replacing by AI. Due to the document-oriented nature of this study, it did not include direct observations of students, interviews with teachers or data from the classroom. Future studies should investigate the independent, AI-supported, collaborative and diminished forms of authorship suggested in the current study in actual classroom settings and examine how institutions are using AI compared to the actual actions of their students.

Ethics statement

This study did not involve human participants, animals, or the collection or processing of personal or sensitive data. The research was based exclusively on publicly available digital artifacts. Therefore, ethical approval and informed consent were not required.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Data Availability

No original datasets were generated or analyzed in this study. The research is based exclusively on a systematic review and qualitative analysis of publicly available scientific literature and published sources. The sources reviewed are accessible through their respective publishers and academic databases.

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