STREAM Education in Higher Education Contexts and Practices

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Abstract: This review examines the literature for recent studies on STREAM (Science, Technology, Reading/Writing, Engineering, Art, Math) education in higher education, with an emphasis on the period between 2020 and 2025. It analyzes publications that meet these selection criteria and considers the approaches, years of publication, scope, methodologies, theoretical frameworks, main findings, implications of work, focus, subject area and the profile of teachers and learners. Our findings reveal that the integration of literacy in STREAM extends STEM and STEAM by encompassing cognitive higher-order skills, affective engagement, and values-based frameworks. Teacher preparation is represented in the literature as a strategic approach for effective future interdisciplinary education. Finally, limitations and prospects are discussed as notable perspectives for curricula transformations.

Key-Words: - Higher education, interdisciplinary pedagogy, STREAM education, teacher preparation, teaching and learning, literature research

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1 Introduction

STREAM (Science, Technology, Reading/Writing, Engineering, Art, Math) education represents an expansion of STEM and STEAM frameworks by explicitly incorporating reading/writing into interdisciplinary learning, [1]. Within higher education, STREAM has gained traction as a vehicle for fostering advanced cognitive skills, creativity, and transdisciplinary collaboration. This paper systematically reviews nine publications published between 2020 and 2025 that explicitly feature STREAM education in their titles and focus on tertiary contexts. By considering methodologies, and theoretical frameworks, analyzing findings and implications, the review identifies emerging motifs and trends while critically examining limitations and prospects. The aim is to provide a comprehensive synthesis that situates STREAM as both a pedagogical innovation and a strategic response to the evolving demands of higher education.

2 Methodology

A standardized bibliographical search was applied (on 12 December 2025) across the following databases: (1) Google Scholar, (2) IEEE Xplore, (3) ERIC and (4) Scopus. In each database, a search of words was applied; both as a search string, i.e. “STREAM education” and independently, i.e. “STREAM AND education”. Originally, no restrictions were applied. Then, the search focused on the period 2015-2026, afterwards on the timeframe 2020-2026, and the year 2026 was examined separately. After manual examination, we selected the papers that their primary focus is higher education, e.g. excluded papers that just provide examples of higher education pedagogy, as well as papers that involved life-long learning; also, all duplicates were removed and only papers available in English language were considered. The same search protocol was employed by restricting the search to titles-only, under the assumption that only dedicated papers to STREAM education would be retrieved. “S.T.R.E.A.M” including full stops in the abbreviation, was also considered.

3 Results

The literature search across four databases yielded a large initial pool of records, which was progressively refined through temporal filters, title-specific queries, and manual screening for relevance to higher education.

Google Scholar produced the largest volume of results. An unrestricted search for "STREAM education" retrieved 3,590 records. Applying a 2015–2026 filter reduced this number to 2,020 (accounting for the 56.3% of original records), while narrowing further to 2020–2026 yielded 1,240 (34.5% of original records). Restricting exclusively to 2026 identified only 2 publications. Limiting the search to article titles returned 91 records, of which 76 fell within the 2015–2026 period and 51 within 2020–2026. These 51 publications were manually screened, with none originating from 2026. A broader query using "STREAM AND education" initially returned 4,450,000 records; filtering to 2020–2026 yielded 349,000, and restricting to titles produced 237 records, of which 65 were manually inspected. Ultimately, 8 results were identified as directly focused on STREAM education in higher education contexts.

IEEE Xplore yielded comparatively fewer records. The unrestricted search retrieved 16 publications, reduced to 11 under the 2015–2026 filter, and further to 10 under the 2020–2026 filter. No records were found for 2026 alone. Restricting to titles produced two records, both within the 2020–2026 period. A broader query using "STREAM AND education" returned 39,132 records, with 19,092 falling within 2020–2026. Here, title restrictions produced 7 records, of which 4 were manually inspected. Only 1 article was ultimately selected as relevant to STREAM in higher education.

ERIC produced 85 records in the unrestricted search, reduced to 46 under the 2015–2026 filter, and to 25 under the 2020–2026 filter. No records were identified for 2026. Title-specific searches yielded 11 records, of which 5 fell within 2020–2026. A broader query using "STREAM AND education" returned 2,442 records, with 469 within 2020–2026. Restricting to titles produced 39 records, of which 11 were manually inspected. Two articles were ultimately selected as relevant to STREAM higher education.

Scopus retrieved 136 records in the unrestricted search, reduced to 130 under the 2015–2026 filter, and to 123 under the 2020–2026 filter. No records were identified for 2026. Title-specific searches yielded 13 records, of which 12 fell within 2020–2026. A broader query using "STREAM AND education" returned 145,795 records, with 83,465 within 2020–2026. Restricting the search to titles-only produced 120 records, of which 55 were manually inspected. Three articles were ultimately selected as relevant to STREAM in higher education.

Overall, the systematic search combining results across the Google Scholar, IEEE Xplore, ERIC, and Scopus databases identified 9 publications that explicitly focus on STREAM education in higher education contexts between 2020 and 2025. These publications formed the corpus for subsequent analysis and synthesis.

4 Literature Review

In this section, the nine publications that met the aforementioned research criteria are analyzed in terms of their positioning and insights. The publications are presented in chronological order; when there is chronological overlap, these are presented in alphabetical order based on the first author's surname. Moreover, a synoptic profile of the publications was created (see Appendix, Table 1) listing the database of origin, publication year, publication type, use of "R" in the STREAM acronym, study focus (e.g., teachers/learners), discipline, and university students' study topic.

4.1 "STREAM Education and Multiple Intelligence Theory: an Analysis of Lesson Plans Proposed by Future Primary and Preschool Teachers", [2]

In this 2020 conference paper, the authors investigate the link between STREAM education and the theory of multiple intelligences (referred to as TIM), namely that humans exhibit eight separate types of intelligence that concern linguistic, mathematical, spatial, musical, bodily-kinesthetic, naturalistic, interpersonal, intrapersonal, and existential skills. The authors evaluated participant perceptions of the connection of STREAM education to multiple intelligences theory via relevant lesson plans and activities. Participants were future preschool and primary education teachers. The authors assessed the developed lesson plans and activities based on an arbitrary set of criteria that they determined and involved the primary STREAM discipline, the disciplines that were underrepresented or insufficiently represented in the activities, the skills and values transferred through the STREAM lesson plan, and finally, how the STREAM lessons mapped onto multiple intelligences. The authors indicated that representation is more accurate in sciences with an emphasis on environmental awareness, but there is confusion with regard to an overlap between

engineering and technology, with poor results in those domains. However, findings suggest that there are several transferable skills, namely analytical, organizational, collaboration, and research skills.

4.2 "The Transformation from STEM to STREAM Education at Engineering and Technology Institutions of Higher Education", [3]

This 2021 review proposes the transition from STEM to the STREAM framework in higher education, with an
emphasis on the engineering and technology fields. The paper focuses on open debates surrounding STEM, STEAM, and STREAM teaching, learning, and pedagogy. It also addresses the policy-making developments in Malaysia and Vietnam, specifically. The suggestion and conclusion are that the inclusion of the Reading element is crucial so that STEM education may be equipped to incorporate collaboration, communication, creativity, and critical thinking (the 4Cs) in higher education. The 4Cs approach in curricula transformation of educational systems will boost student 21st century skills, rendering them competent for the challenges of the fourth industrial revolution.

4.3 "STREAM: A New Paradigm for STEM Education", [4]

The 2021 publication discusses how, even though STEM education has been acknowledged as beneficial and relevant to the current educational but also professional and financial global market, multiple statistical analyses show that US is currently somewhat lagging in its effective implementation. To address this issue, several approaches are being investigated in the relevant literature. The indicated consensus is that this problem may be alleviated through the introduction of interdisciplinarity by means of educational experiences that are affective, interactive, and engaging. Arts education may improve classroom performance and academic achievement; that is in STEAM education, divergent and creative thinking is fostered along with problem-solving and critical thinking. With the addition of recreation in STREAM education, physical activity is encouraged, aiming for both physical and psychological wellness. In this study, researchers introduced an active learning module to teach the concept of Distributed (or Shared) Ledger, a key concept in Blockchain technology. The focus group that followed indicated that participants deemed the activity experiential, fun, instructive, interactive, and overall effective and rewarding.

4.4 "The Introduction of Augmented Reality in STREAM Education Impacts Science Students' State Emotions", [5]

The 2024 article discusses an Augmented Reality (AR)-enriched STREAM intervention, employed in a higher education English course aimed at two groups of natural sciences students. Its focus lies on how contemporary and 18th-century art and literature prompts may impact academic emotion. Relevant research in higher education, especially concerning science students, is limited. Participants were life sciences and physical sciences students, whose first language is not English and that have not previously encountered AR applications in their curricula. Students were requested to assess their emotions prior and post intervention via questionnaires, as well as their experience. Subsequently, they engaged with applications, creating their own 3D art. Students were asked to reflect on their experience and to produce a creative writing task, namely a sci-fi story. Students' positive emotions were significantly enhanced, especially in the life sciences student group. Both life and physical science groups demonstrated a significant decrease in negative emotion. Furthermore, the overall intervention was well received by the students, and the lesson was deemed compelling. The study is aligned with existing literature in terms of the positive impact of AR on academic emotion. There is also modulation of negative emotion in contrast with previous literature where this aspect appears underrepresented. The authors suggest future hands-on research in AR-assisted STREAM practices in higher education, especially in English course settings.

4.5 "Bridging the Gaps of Science/Social Science Education Technology with Values-Based Framework Development: Exemplary Transdisciplinary Studies Related to STREAM", [6]

The 2024 study is a book chapter that centers on sustainable, values-based STREAM education, [7], situated mainly in higher education settings. In this study, STREAM education serves as a connector between science and social science education. It is a project-based, mixed-methods research that employs technology and empirical models. The participants of the study were mainly university students and educators that were involved in a climate change competition and a primary school Minecraft project. A primary school team was included as an exemplary case, not as part of the main sample. Digital learning tools and platforms were employed to examine how

technology-assisted STREAM education supports sustainable learning. In this study, a mixed-method approach was pursued; Cross-Case Analysis was conducted to identify patterns across STREAM projects and a model was employed to test and verify the reliability of this conceptual framework. Findings revealed common educational patterns across STREAM science and social science projects, in terms of level of participant collaboration, reflection, and inquiries. This outcome demonstrates the convergence between the two disciplines, proving STREAM's transferable and scalable nature. Further analysis unveiled systematic relationships between e-tools, transdisciplinary pedagogies, and value-based, sustainable STREAM projects, providing empirical support to the hypothesis. To this end, STREAM seems to function as an integrative system between science and social science, proving the structural viability of values-based sustainable STREAM education.

4.6 "STEM, STEAM or STREAM‐Education: It Is Your Choice!", [8]

The 2024 article discusses the application of STEM, STEAM, and STREAM practices in environmental projects for prospective teachers enrolled in natural science programs at a Ukrainian university. This empirical research aims to tackle the research gap in currently applied STEM pedagogies; teacher training appears to be somewhat lacking in this aspect, and subject-specific. Nonetheless, in a highly dynamic environment, educational practices call for multi-modal approaches. To this end, employing literacy in traditional STEM-based methodologies merits further research and systematic incorporation. The article compares the theories of STEM, STEAM, and STREAM education. Following up, environmentally based projects were strategically implemented in the curricula. Participants were natural science students, enrolled in teaching programs, as well as in-service teachers with a supporting role in the research. Students were divided into two groups: STREAM group and control group, where students employed traditional pedagogies. A qualitative and quantitative analysis was used to compare the effectiveness of the two approaches. The STREAM group students exhibited greater engagement and professional initiative, while the control group students did not achieve the same level of competence. Thus, authors propose a curriculum transformation towards the inclusion of interactive environmental projects in teacher preparation.

4.7 "Integrating Reading and Writing With STEAM/STEM: A Systematic Review on STREAM Education", [9]

The 2024 article presents a systematic review of empirical studies up to 2021 on STREAM education. All publications apart from one appear to have been published after the year 2015, with a clear peak in 2020. The review critically examines prevailing methodological approaches, along with contributions to students' performance. It employs Bloom's taxonomy to evaluate the cognitive complexity of literacy activities across different studies and explores variations in overall effectiveness across different educational levels. Selected studies were analyzed according to 10 features: (1) time, (2) school level, (3) reading, (4) writing, (5) art, (6) discipline, (7) gender, (8) race, (9) cognitive goal, and (10) learning process. Bloom's Taxonomy was implemented as an analytical framework to hierarchically classify students' cognitive goals, from lower to higher-order thinking. Generally, although studies are focused on college-level settings, there is a gradual shift towards lower levels of education, middle and primary school. The focus, nonetheless, is on either higher or primary education. Writing-focused studies dominate STREAM research as a reflective output, especially in higher education settings. Reading approaches, despite the emerging interest from 2017 and so on, remain limited and mainly reflect on lower educational levels. Importantly, a limited number of studies integrate both reading and writing. In addition, authors denote the absence of a coherent pedagogical framework across educational levels in integrating "R" in teaching, with limited attention on the cognitive goals and competencies. Authors underscore the need for a deeper and more systematic pedagogical approach, with a shift towards instructional designs to connect reading and writing directly to learning and cognitive goals and objectives. A gradual build-up to STREAM integration in the curricula is recommended, to differentiate cognitive goals in alliance with the age group. Supporting conceptual understanding and interdisciplinary learning should be considered as an educational policy to reinforce the creativity of the students. According to the authors, students should engage in hands-on activities and experiential learning, utilizing diverse, technology-driven materials during their learning. With respect to future developments, greater attention should be given to adding the element of literacy into STEM educational frameworks and thoroughly examining the affective dimensions of STREAM education. Excluding broader contextual factors, namely gender, race, region, and

socioeconomic status, highlights the tokenistic approach in STREAM research.

4.8 "Investigating the Relationship Between Metacognition and STREAM Education in Science: An Exploratory Study", [10]

This 2024 empirical study investigates the relationship between metacognition and STREAM knowledge in science education. Participants were prospective female primary and preschool teachers, from both rural and urban areas, in their 3rd year of studies. Students were required to complete two self-report questionnaires: the Metacognitive Awareness Inventory and the STREAM integration scale. These were implemented to assess the metacognitive awareness of the participants and their ability to employ the pedagogies in the curriculum, respectively. Data underwent analyses to examine the relation and the predictive capacity of the two variables. Results revealed a significant relationship between metacognition and STREAM. Notably, metacognition is a significant predictor of STREAM knowledge. This points to the confirmation of the hypothesis, that students with better-developed metacognitive functioning can more effectively understand and employ STREAM instructional designs in teaching; also, that STREAM competence is a variable depending on metacognitive awareness. Therefore, high cognitive functions and self-regulatory skills set the grounds for pioneering interdisciplinary STREAM classrooms. Given that metacognition plays a central role in supporting STREAM education, future studies should address this interplay in various educational levels. To support the broader applicability of the results, further studies should also reflect different professional backgrounds and geographical areas, as well as encompass standardized instruments to measure effects. These questions are currently under-investigated in the literature and merit thorough exploration.

4.9 "STREAM: Integrating Storytelling and Robotics into STEAM Education", [11]

In this 2025 study, storytelling and robotics were added to STEAM instruction to transform this educational framework into an interdisciplinary learning experience. In particular, the article describes the integration of robotics, reading and writing literacy to art education to promote pre-service art teachers' creativity and interdisciplinary thinking. The authors highlight the plethora of advantages robots may bring to art education and practice. They claim that most prospective teachers lack basic knowledge of robotics, thus they are not well-prepared to integrate robotics into their own teaching. In this study, fourteen students, who were pre-service art teachers, participated in a series of lessons aimed at familiarizing students with the basic principles of coding, as well as the concept of digital storytelling in the visual arts. Students engaged in simple coding and creative thinking activities, programming the robot accordingly to produce appealing visual stories. Teacher and student reflections showed that students benefited from the experience and saw educational and aesthetic value in the inclusion of robots in their workflow.

5 Literature Synthesis

In this section, the literature is synthesized to identify and describe themes & motifs, methodological tendencies, implications for higher education, limitations, and prospects.

5.1 Themes & motifs

A prominent theme is the expansion of STEAM into STREAM through explicit integration of literacy (reading and writing), seen both in conceptual framings and in empirical studies that foreground reflective writing and communication as core learning processes. The element of literacy consistently correlates with higher-order cognitive aims -analysis, synthesis, metacognition, and reflective practice- particularly in higher education contexts where disciplinary integration is feasible and desirable. Alongside literacy, arts-based methods and creative practices appear as motifs across studies, serving as bridges between technical content and humanistic inquiry, and enabling project-based, narrative, and design-thinking approaches. Another important theme of STREAM instruction concerns the use of technology, such as the incorporation of AR or robotics, to boost interdisciplinary learning, conceptual thinking, and experiential learning, also aiming to promote students' emotional involvement. In addition, values-based frameworks provide an ethical, cultural, and philosophical dimension to the STREAM model, tapping into the current needs of modern societies. Lastly, the present literature review unveiled a common theme amongst the publications that met the selection criteria: a general focus on teacher preparation. This may be a strategic choice, aimed at equipping and motivating prospective teachers to thrive in interdisciplinary approaches.

5.2 Methodological tendencies

The publications presented in this study vary in terms of their methodological context, ranging from qualitative studies and theoretical analyses to empirical and mixed-methods research. This variation in frameworks showcases the exploratory and promising nature of this type of literature.

5.3 Implications for higher education

Findings support that STREAM instruction promotes multi-modal, interdisciplinary, and transdisciplinary teaching and learning. This serves both as a pedagogical framework of educational value and as an effective creative and artistic means of expression for university students, enabling them to become emotionally involved during the learning process. These findings are of interest not only for learners, prospective and in-service teachers, but also for education policy-makers, for the purpose of informing current educational practices and implementing future curriculum transformations.

5.4 Limitations

The study presents several limitations. First, the sizes of the samples in the analyzed publications are rather modest, which may impede the process of drawing general conclusions. Second, there is a tendency towards examining short-term skills transfer rather than investigating long-term effects of STREAM instruction. Third, the majority of the publications focuses on specific national contexts, not favoring diversity in terms of representation of ethnic or other groups. Finally, literature is relatively small but has expanded rapidly in recent years.

5.5 Future prospects

Research in STREAM education may benefit from multi-method approaches aimed at assessing the impact of STREAM instruction in terms of student emotional gain, acquired metacognitive awareness, interdisciplinary learning, and student engagement. Technological applications, such as the use of AR and robotics, may also become a fundamental aspect of STREAM curricula in higher education to further familiarize university students with cutting-edge technology. In addition, to draw generalized conclusions, there is an identified need for extensive, multi-site educational interventions that would include larger and more heterogenous sample sizes. Longitudinal studies would also be of interest to provide insight into the long-term effects of the implementation of STREAM pedagogy.

6 Conclusion

This review demonstrates that STREAM education in higher education has evolved into a multidimensional paradigm that integrates literacy, arts, technology, and values with traditional STEM disciplines. The nine studies analyzed reveal STREAM's capacity to foster creativity, metacognition, interdisciplinary collaboration, and affective engagement, while also highlighting its role in teacher preparation and institutional transformation. Despite limitations such as small sample sizes and restricted geographical scope, STREAM emerges as a promising framework for cultivating competencies and ethically grounded innovation in higher education. Future research should expand empirical evidence, strengthen theoretical models, and explore curricular approaches that align with global educational priorities.

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References:

[1] L. Gavrilas, and K. T. Kotsis, The Evolution of STEM Education and the Transition to STEAM/STREAM, *Aquademia*, Vol. 9, Issue 1, 2025, ep25002. https://doi.org/10.29333/aquademia/16313

[2] I. Sabou Baboş, M. Bărnuțiu Sârca, and L. Ciascai, STREAM Education and Multiple Intelligence Theory: an Analysis of Lesson Plans Proposed by Future Primary and Preschool Teachers, in *Proceedings of ICERI2020*, Online Conference, 2020, pp. 8477–8482. https://doi.org/10.21125/iceri.2020.1887

[3] H. T. T. Nguyen, S. Sivapalan, and P. H. Hiep, The Transformation from STEM to STREAM Education at Engineering and Technology Institutions of Higher Education, in *Proceedings of SHS Web of Conferences*, *ICMeSH2020*, Virtual (Malaysia), Vol. 124, 2021, pp. 07003. https://doi.org/10.1051/shsconf/202112407003

[4] T. Yoh, J. Kim, S. Chung, and W. Chung, STREAM: A New Paradigm for STEM Education, *Journal of STEM Education: Innovations and Research*, Vol. 22, Issue 1, 2021, pp. 46–51. https://www.jstem.org/jstem/index.php/JSTEM/article/view/2438 (Accessed Date: February, 20, 2026)

[5] E. Kleidara, M. Gkouzioni, C. Tzima, A. Moutzouris, K. Plakitsi, and L. V. Andreou, The

Introduction of Augmented Reality in STREAM Education Impacts Science Students' State Emotions, in *Proceedings of the 2024 IEEE Global Engineering Education Conference (EDUCON)*, Kos Island, Greece, 2024, pp. 1–5. https://doi.org/10.1109/EDUCON60312.2024.10794654

[6] K. T. Ng, S. Parahakaran, K. Intaratat, X. Z. Guan, Y. F. Lay, J. H. Ng, E. T. Ong, Y. Y. Ng, E. Retnowati, M. Fukui, S. Anggoro, and R. Kumar, Bridging the Gaps of Science/Social Science Education Technology with Values Based Framework Development: Exemplary Transdisciplinary Studies Related to STREAM, In *Transdisciplinary Approaches to Learning outcomes in Higher Education*, edited by R. Kumar, E. Ong, S. Anggoro, and T. Toh (eds.), pp. 347–379, ISBN13: 9798369336991, IGI Global, 2024,. https://doi.org/10.4018/979-8-3693-3699-1.ch011

[7] G. J. Biesta, Why "What Works" Still Won't Work: from Evidence-Based Education to Value-Based Education, *Studies in Philosophy and Education*, Vol. 29, Issue 5, 2010, pp. 491–503. https://doi.org/10.1007/s11217-010-9191-x

[8] *(text in Russian)* A. Stepanyuk, L. Mironets, T. Olendr, and M. Zhyhadlo, STEM, STEAM or STREAM‑Education: It Is Your Choice! (Stem, Steam Чи Stream-Освіта: Вибір За Вами!), *Scientific notes of the Mykhailo Kotsiubynskyi Vinnytsia State Pedagogical University. Series: Theory and methodology of teaching natural sciences*, Issue 7, 2024, pp. 86–96. https://doi.org/10.31652/2786-5754-2024-7-86-96

[9] W. Sun, and B. Zhong, Integrating Reading and Writing With STEAM/STEM: A Systematic Review on STREAM Education, *Engineering Education Journal*, Vol. 113, Issue 4, 2024, pp. 939–958. https://doi.org/10.1002/jee.20569

[10] L. Şuteu, R. M. Cristea, I. Magdaş, and L. Ciascai, Investigating the Relationship Between Metacognition and STREAM Education in Science: An Exploratory Study, *RREM*, Vol. 16, Issue 1, 2024, pp. 30–45. https://doi.org/10.18662/rrem/16.1/810

[11] K. Lim, and S. G. Lee, STREAM: Integrating Storytelling and Robotics into STEAM Education, *The International Journal of Art and Design Education*, Vol. 44, Issue 3, 2025, pp. 1–17. https://doi.org/10.1111/jade.12611

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Conflict of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

APPENDIX

Table 1. Literature search results and synoptic profile analysis of findings. The publications yielded after the application of the selection criteria are presented here, combined across the databases used in the study.

ID	Database	Publication Year	Publication Type	Use of "R" in STREAM	Study Focus	Discipline	University Students' Study Topic
[2]	Google Scholar	2020	Empirical Research Article	Reading/Writing	Prospective Teachers	Teacher Education	Preschool and primary school future teachers
[3]	Google Scholar	2021	Review	Reading	Teaching & Learning, Pedagogy, Educational Policymaking	STEM fields	STEM with an emphasis on engineering and technology
[4]	ERIC	2021	Empirical Research Article	Recreation*	Learners	Information Technology	College students from mixed academic backgrounds
[5]	Google Scholar, IEEE Xplore, Scopus	2024	Empirical Research Article	Reading/Writing	Learners	Natural Sciences	Life sciences and physical sciences
[6]	Google Scholar	2024	Theoretical Paper (book chapter)	Reading/Religion**	Teaching & Learning	Science/social science	Science/social science education
[8]	Google Scholar	2024	Empirical Research Article	Reading/Writing	Prospective Teachers	Science Teacher Education	Prospective natural science teachers
[9]	Google Scholar, ERIC, Scopus	2024	Review	Reading/Writing	Teaching & Learning	STEM fields	STEM
[10]	Google Scholar	2024	Empirical Research Article	Reading	Prospective Teachers	Science Teacher Education	Preschool and primary school future teachers
[11]	Google Scholar, Scopus	2025	Empirical Research Article	Reading/Writing	Prospective Teachers	Art Education	Pre-service art teachers

*This publication is not excluded, even though it may be considered as an outlier ("R" here stands for "Recreation"). That is to demonstrate that STREAM in the literature appears to be an elastic acronym, albeit in the vast majority of publications "R" refers to Reading/Writing literacy.

**This publication meets the selection criteria; it is not excluded from the study, even though "R" here stands for Reading/Religion. Here, "R" represents elements of social science to refer to broader cultural contexts.
Source: Created by the authors