A Systematic Literature Review of STEAM in Early Childhood Education in Indonesia (2018-2022): Innovation of Learning for Children

E. C. Maulidiyah[1], S. Setyowati[2], M. Reza[3], D. Komalasari[4]

[1,2,3,4]*Early Childhood Education, Surabaya State University, Surabaya, Indonesia*

ekamaulidiyah@unesa.ac.id

Abstract. Interest and adjustment to future configurations make STEAM (Science, Technology, Engineering, Arts, Math) learning very in demand in the century this . Value or values given to STEAM education is not can denied is means For develop Skills basics , competence and solving difficulty life real in children age early . On research This use method literature review review with using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). Analysis of research This will focused on implementation education STEAM- based in children age early in Indonesia use published journal _ in journal national and international . Objective study This is For analyze extent of research about implementation learning STEAM- based education child age early . Based on criteria There were 24 journals collected and analyzed with indicator Title , author, name journal , year rising , kind journal , discipline main , method research , data collection , samples and data analysis . Research findings _ This show that STEAM research in children age Early childhood in Indonesia in 2018-20203 was dominated by topics lerning media is most topics _ researched in journal for STEAM on level education child age early in Indonesia study this . The importance of learning media like bridge For teach learning to child . Most implementations in language learning _ _ in STEAM for child early age in Indonesia is Game in journals study This very very diverse start from study from the most researched game _ that is with using loose-parts, loose-parts themselves freeing child in get creative as well as can hone how to solve children's problems. Theme Dominant related STEAM learning in children age early in Indonesia is about draft Mastery of STEAM Alone like level teacher mastery in application of STEAM to children age early in Indonesia . There is a number of topic potential research _ For developed in STEAM in children age early in Indonesia.

Keywords: Steam; Early Childhood Education Programs; Alternative

1 Introduction

Initially STEAM (Science, Technology, Engineering, Arts, Mathematics) itself formed without any great art called STEM (Science, Technology, Engineering, Mathematics) which existed in the 1990s and originated from the National

A. Mustofa et al. (eds.), *Proceedings of the International Joint Conference on Arts and Humanities 2023 (IJCAH 2023)*, Advances in Social Science, Education and Humanities Research 785,
https://doi.org/10.2991/978-2-38476-152-4_187

Science Foundation in the United States as well as the European Union [1]. STEM itself aim integrate knowledge knowledge multidisciplinary as such key deep understanding and meaningful learning [2]. In line with the development of STEM in American schools , there is various models and approaches pedagogical For develop as well as integrate art into STEM. In IJPTE or International of Pedagogy and Teacher Education arts in education can push creativity, innovation as well as skills children and outcomes as well as benefit from education art This become inspiration like the STEAM concept was introduced in the United States in 2007 [3].

A number of points important from STEM to STEAM is as here's the first one STEM to STEAM learning is not each other contradictory but each other expand room scope learning , the second in STEAM learning is philosophy that develops the teacher within pursuit science in development education 21st century , the third on STEAM learning provides room creative for internal teachers develop integrated curriculum , the fourth in STEAM education teachers can take inspiration in learning based project , the fifth STEAM learning engages children in learning transformative based on five ways mutual knowledge _ related : knowledge culture , knowledge relational , knowledge critical , visionary and ethical knowledge , and erudition in action [4].

Learning STEAM- based is answer For learning that can be done used For develop various type skills and creativity in children as well as face progress technology. STEAM- based education strives prepare child For solve problem in a way direct and real through creativity , collaboration , and effective communication in context knowledge new [5]. Different with approach teaching conventional, technological STEAM education is methodology new For teach purposeful child _ For teach child four knowledge in a way integrated namely: Science , Technology , Engineering , Arts and Mathematics [6].

STEAM applied to children age early assessed impact positive No only in learning but also deep increase diversity child For build sharpness in analyze , reason and own broad and complex understanding , and also helpful child For develop himself in various field No only develop in matter cognitive just [7,8]. Besides the Next Generation Science Standards (NGSS) also recommends that child age early is the right time For start quality STEAM education [9]. In line with curriculum independent about process standards in education child age early and how For reach objective Study done through designed learning strategies give experience quality learning with apply material on the problem or context real as well as push interaction and participation active participant educate For optimizing use source power available in the environment in the environment use device technology information and communication To use prepare children own Skills 21st century and for face challenge change public fast economy and technology [10].

So from That introduction STEAM concept since age early giving _ child learning underlying meaning _ experience future education [11].
A number of study I have done it before too investigating STEAM in children age in the international world, including integrating and navigating [12] STEAM in early childhood education a literature review steam learning in early childhood education [13], A systematic literature review of STEAM education in Indonesia [14] , Publication trends for STEAM in education [15] . Differentiator study This is use journal from 2018-June 2023 with criteria journal use Indonesian and languages english ; quality journal journal sinta 2 to scopus , with objective know to what extent STEAM is studied in field child age early in Indonesia.
With objective study This is For analyze extent of research about STEAM in learning child age early. In the process of collection relevant information can helped with preparation details of the RQ or Research Question, namely:

Table 1. RQ (Research Question)

RQ 1	Topic what is most explored _ from STEAM research in education child age early from 2018- June 2023 ?
RQ 2	How implementation of STEAM in learning child age early ?
RQ 3	What just theme dominant related with innovation Steam learning in PAUD?
RQ 4	Topic study what has the most potential For developed in the future ?

2 Methods

In study This use SLR (Systematic Literature Review) method with related content analysis approach with STEAM education for children age early from year 2018- June 2023. Population and samples in research This searching for using Publish or Perish and Vos Viewer, samples in research This there are 24 journals. Journals related with STEAM in children age early on the Google Scholar, Garuda and ERIC databases with using the keywords " STEAM education for children age early childhood ", "STEAM education in early childhood", "STEAM Indonesia". In the SLR procedure in study This use PRISMA (Preferred Reporting Item for Systematic Reviews and Meta-Analyses) data collection.

Table 2. Stages data collector

No.	Stages

1.	Data selection includes formulation question research and identification journal , determination criteria journal , screening journals in various databases (google Scholar , Garuda and ERIC)
2.	Instrument coding modification from Paper Classification From (PCF) developed by (Kizilaslan et al., 2012) . Instrument This has fulfil condition validation and reliability . Indicators used _ in the PCF includes title , author , author's country , name journal , year rising , kind journal , language , index , discipline science, method research , data collection , samples and data analysis . Researchers also create covering data matrix objective research , learning models , themes and findings , data provided collected furthermore will analyzed with use presentation .
3.	Identify pattern journal that is findings , integration STEAM education , skills achieved and implementation of STEAM in children age early .
4.	Analyze pattern For answer question research .

Analysis of researcher data count percentage from every findings and analysis the cause

Table 3. Inclusion and Exclusion Criteria

No.	Categories	Inclusion Criteria	Exclusion Criteria
1.	Type Publication	Published journals _ in journal	Published journals _ in proceedings conference , book , website or blog
2.	Year Publication	2018 – August 2023	Less than 2018
3.	Specification Journal	Minimum accredited journal sinta 2 and journal international Scopus indexed	Journal national No accredited or accredited sinta 3-5 and journal international No indexed Scopus .
4.	Background Study	Indonesia	Abroad _
5.	Nationality Study	Indonesia, a collaboration of Indonesians and foreigners	Just a foreigner
6.	Variable Independent	STEAM education, STEAM Indonesia or STEAM for children age early	STEM or not STEAM

7.	Field	Education or education child age early	Outside education or education child age early
8.	Subject Study	Early Childhood _	Outside child age early

3 Findings and Discussion

In this Systematic Literature Review research study published journal _ from 2018 to June 2023 which will be carried out in Indonesia. For distribution journal use criteria inclusion that is Published journals in journal , Journal at least accredited sinta 2 and journal international Scopus indexed 2018 – August 2023 background behind research in Indonesia, nationality study Indonesia or collaboration between Indonesians and foreigners , is in the field of STEAM

education, STEAM Indonesia or STEAM for children age early Education or education child age early and subject study is child age early (Table 2).

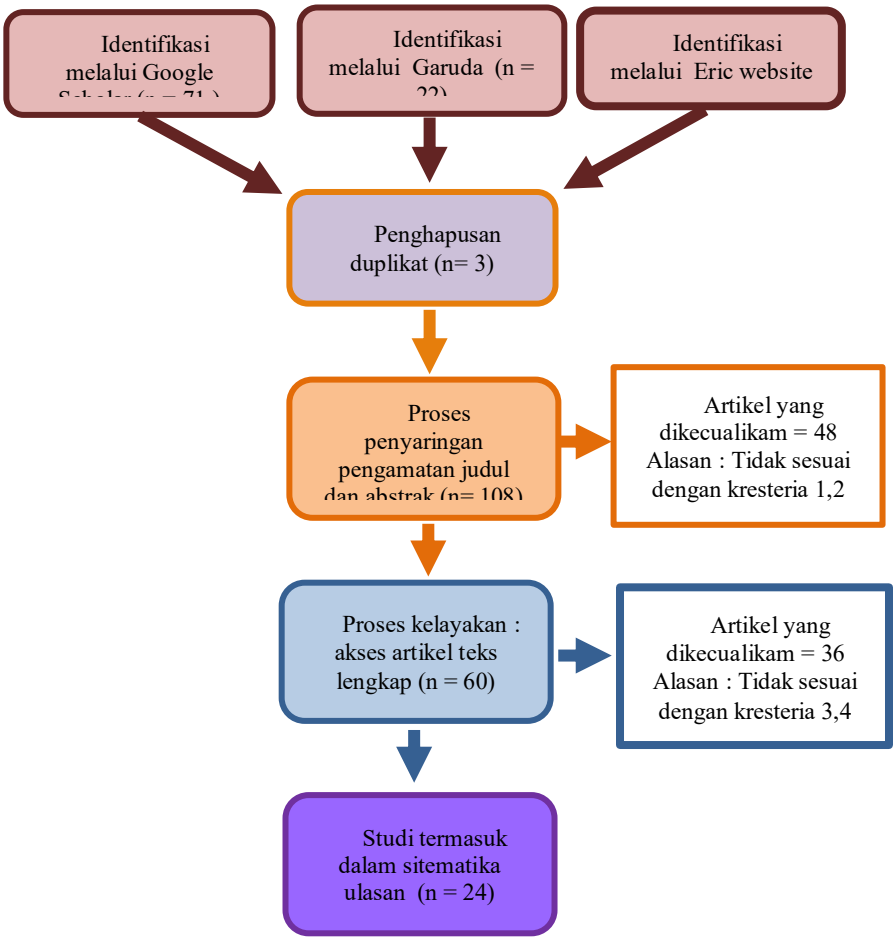

Figure 1. Research procedures

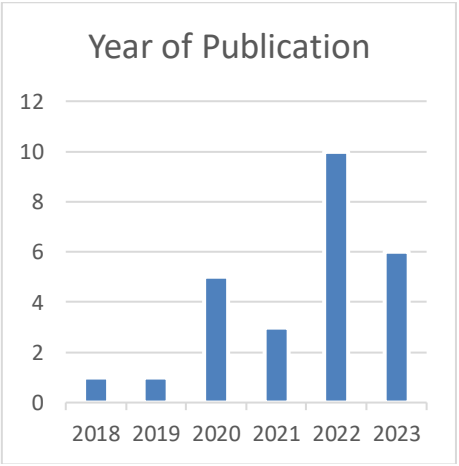

Figure 2. Year of Publication

Table 4. Type of Journals

Type Journal	Journal Grade	Journal Name	Frequency	References
National	Sinta 2	Journal Obsession : Journal of Early Childhood Education	12	(Rini et al., 2022) ; (Wahyuningsih et al., 2019) ; (Yanuartini Rahayu et al., 2023) ; (Suryaningsih et al., 2023) ; (Agusniatih & R., 2022) ; (Pramudyani & Indratno, 2022) ; (Ratna et al., 2023) ; (Sit & Rakhmawati, 2022)
		Journal of Early Childhood Education	3	(Rahardjo, 2019) ; (Hapidin et al., 2020) ; (Hapidin et al., 2023)
		International Journal of Pedagogy and Teacher Education (IJPTE)	1	(Budiyanto et al., 2021)
International	Q2	EURASIA Journal of	1	(Ng et al., 2022)

	Mathematics, Science and Technology Education		
	KnE Social Science	1	(Kurniasih et al., 2022)
	lifelong education journal	1	(Rachmah et al., 2023)
Q4	Atlantis Press	3	(Putri & Taqiudin, 2021) ; (Anisa & Tri Wulandari, 2018) ; (Muntomimah & Wijayanti, 2021)
	Educational Administration: Theory and Practice	2	(Masganti Sit & Department, 1967)

Study to STEAM education in education child age early in Indonesia own discuss various type topic . Dominating topic _ in study This is about Learning Strategies in STEAM Alone next is Learning Media, literacy scientific , teacher perception and evaluation or mark learning of STEAM in children age as early as possible seen in figure 3.3.

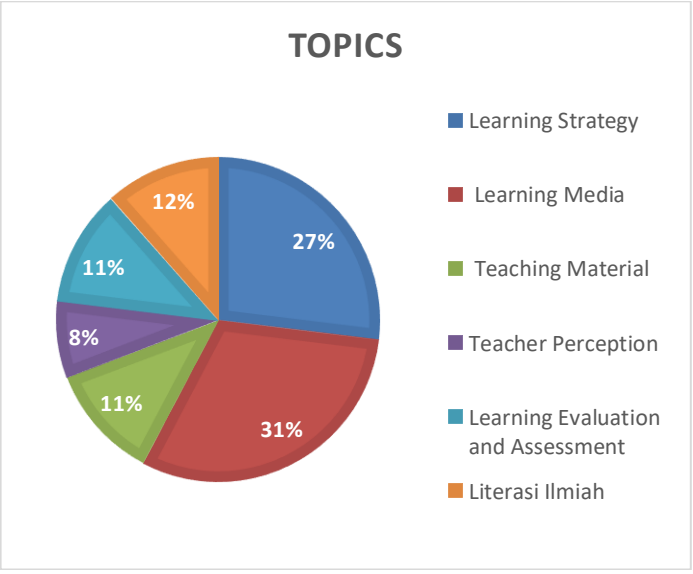

Figure 3. Topics of research in STEAM Education

Learning media is most topics _ researched in journal for STEAM on level education child age early in Indonesia study this . The importance of learning media like bridge For teach learning to child This in line with opinion [16] which reveals that learning media is powerful way in give learning in children through something real. Topic second dominant in STEAM education for children age early in Indonesia is Learning Strategy which is p This containing about the STEAM concept Alone in its application to children age early . This result different with opinion [14] who researched about STEAM and STEM in Indonesia thoroughly no matter what limited level education that produces results his research disclose bring learning strategy is the most dominant topic in STEAM or STEM.

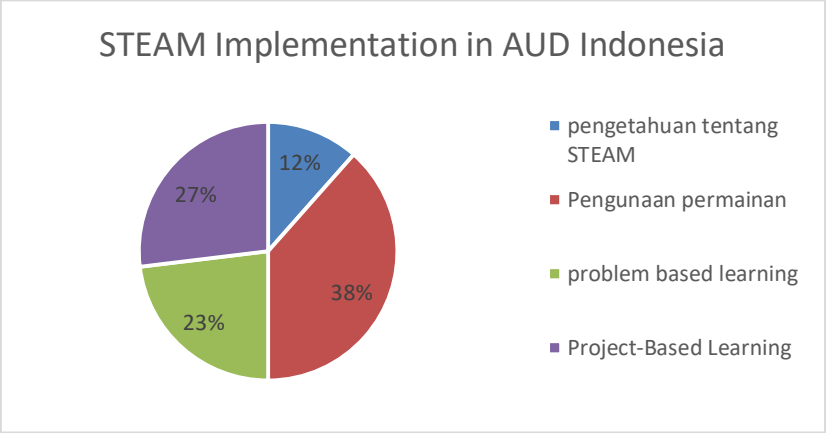

Figure 4. STEAM Implementation in AUD Indonesia

Outside _ nergri STEAM is enough learning _ popular in some year this . In Indonesia, too popular as well as learning with use this STEAM method matter This can seen increasing journals STEAM research in Indonesia from year whatever year you can seen in Figure 3.2. On research This implementation of STEAM in learning child age Early childhood in Indonesia is the most dominant thing done is use game , then project based learning, then problem based learning, and finally knowledge about that STEAM yourself . Game in journals study This very very diverse start from study from the most researched game _ that is with using loose-parts, loose-parts themselves freeing child in get creative as well as can hone how to solve children's problems [17,18,19,20]. Next, deep problem based learning study This is innovation from learning STEAMyang has been modified in accordance with problems that have found for example in the journal researched by Hapidin et al., [21] This developing STEAM into R-SLAMET which is innovation from STEAM learning which adds R , namely Religion or religion and L, namely Literacy , in addition that, Putri and Taqiudin [22] also innovated STEAM with add PBL or Based Learning Project that maximizes communication skills in children .

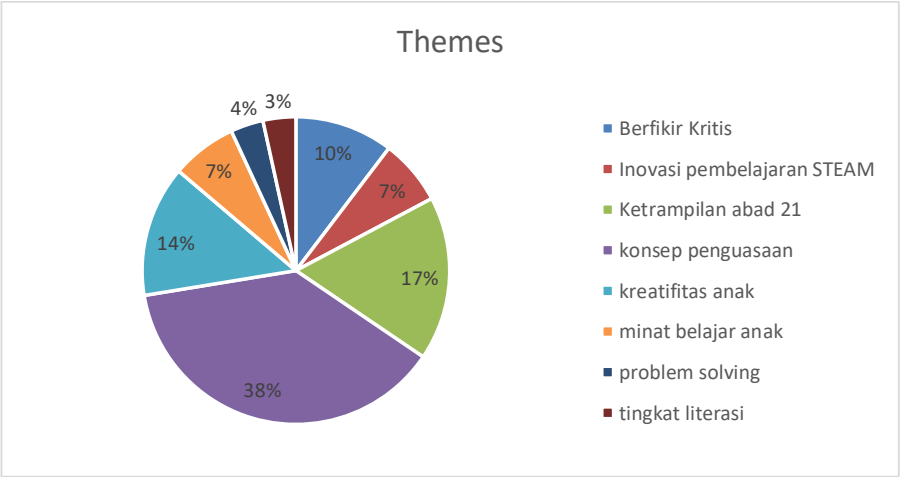

Figure 5. Themes

Theme dominant related with innovation STEAM learning in children age early is about draft Mastery of STEAM Alone like level teacher mastery in application of STEAM to children age early in Indonesia [21,23,24,25]. Besides it's in position second theme related learning _ with STEAM innovation in children age early in Indonesia is skills 21st century as in the journal [26,27,28,13]. This because of which STEAM it is Alone is method with objective main For dig skills developing technology rapidly in the 21st century [29].

STEAM itself assessed capable increase ability child in think critical , solving problems and skills technology To use balance developments in the 21st century [30,28,31,32]. Based on review a number of researched journals _ in study This there is a number of topic potential research _ For developed in STEAM in children age early in Indonesia , namely (1) Development and research of game media or innovative teaching materials To use develop interest Study child in increase abilities in the STEAM method , (2) integration of STEAM with learning event directly at PAUD, (3) make innovation related themes and topics on STEAM in PAUD.

4 Conclusion

STEAM research in children age Early childhood in Indonesia in 2018-20203 was dominated by topics lerning media is most topics _ researched in journal for STEAM on level education child age early in Indonesia study this . The importance of learning media like bridge For teach learning to child . Most implementations in language learning _ _ in STEAM for child early age in Indonesia is Game in journals study This very very diverse start from study from the most researched game _ that is with using loose-parts, loose-parts themselves freeing child in get creative as well as can hone how to solve children's problems. Theme Dominant related STEAM learning in children age early in Indonesia is about draft Mastery of STEAM Alone like level teacher mastery in application of STEAM to children age early in Indonesia . there is a number of topic potential research _ For developed in STEAM in children age early in Indonesia , namely (1) Development and research of game media or innovative teaching materials To use develop interest Study child in increase abilities in the STEAM method , (2) integration of STEAM with learning event directly at PAUD, (3) make innovation related themes and topics on STEAM in PAUD.

Possible advice given for researcher furthermore is can develop a number of topic potential research _ for STEAM development in children age early in Indonesia (1) Development and research of game media or innovative teaching materials To use develop interest Study child in increase abilities in the STEAM method , (2) integration of STEAM with learning event directly at PAUD, (3) make innovation related themes and topics on STEAM in PAUD.

References

1. Arifin, Z., Sukarmin, S., & Sarwanto, S. (2021). Research and Trends on STEM Education in Indonesia: A Systematic Review Based on Bibliometric Mapping (2000-2020). Psychology and Education , 58 (5), 3235–3243.
2. Baharin, N., Kamarudin, N., & Manaf, UKA (2018). Integrating STEM Education Approach in Enhancing Higher Order Thinking Skills. International Journal of Academic Research in Business and Social Sciences , 8 (7), 810–821. https://doi.org/10.6007/ijarbss/v8-i7/4421.
3. Perignat, E., & Katz-Buonincontro, J. (2019). STEAM in practice and research: An integrative literature review. Thinking Skills and Creativity. , 2010 , 1–34. https://doi.org/. https://doi.org/10.1016/j.tsc.2018.10.002.
4. Rizka, SM, Rosita, D., & Safhida, M. (2021). APPLICATION OF STEM LEARNING FOR EARLY CHILDREN. Journal of Language and Literature , 15 (2), 6. https://doi.org/https://doi.org/10.24815/jbs.v15i2.24198.
5. Herro, D., & Quigley, C. (2016). Innovating with STEAM in middle school classrooms: remixing education. On the Horizon , 24 (3), 190–204. https://doi.org/10.1108/OTH-03-2016-0008
6. Hasbi, M., Fardhana, NA, Budiyanti, H., Koesoemawardhani, L., Nurani, Y., Mangunwibawa, AA, & Novrani, A. (2022). Building a STEAM Foundation Through Play Activities . Directorate of Early Childhood Education
7. Bagiati, A., & Evangelou, D. (2015). Engineering curriculum in the preschool classroom: the teacher's experience. European Early Childhood Education Research Journal , 23 (1), 112–128. https://doi.org/10.1080/1350293X.2014.991099.

8. Dejarnette, N. K. (2018). Implementing STEAM in the Early Childhood Classroom. European Journal of STEM Education , 3 (3), 18.
9. National Research Council. (2011). Successful K-12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering, and Mathematics. In 978-0-309-21296-0 . The National Academies Press. https://books.google.com/books?hl=en&lr=&id=kTNO_YZvBmsC&oi=fnd&pg=PR1&dq=policy+and+technology&ots=Zmkr0KqiD8&sig=001O3G2yz-DIIWEw-MeutVWqk38%0Ahttps://nap.nationalacademies.org/13158.
10. Eka Retnaningsih, L., & Patilima, S. (2022). Independent Curriculum in Early Childhood Education. PGRA Study Program Journal , 8 (1), 143–158.
11. Ata-Aktürk, A., & Demircan, H. Ö. (2021). Supporting Preschool Children's STEM Learning with Parent-Involved Early Engineering Education. Early Childhood Education Journal , 49 (4), 607–621. https://doi.org/10.1007/s10643-020-01100-1
12. Ng, A., Kewalramani, S., & Kidman, G. (2022). Integrating and navigating STEAM (inSTEAM) in early childhood education: An integrative review and inSTEAM conceptual framework. Eurasian Journal of Mathematics, Science and Technology Education , 18 (7). https://doi.org/10.29333/ejmste/12174.
13. Wahyuningsih, S., Pudyaningtyas, AR, Hafidah, R., Syamsuddin, MM, Nurjanah, NE, & Rasmani, UEE (2019). The Effect of the STEAM Method on the Creativity of Children Aged 5-6 Years. Obsession Journal: Journal of Early Childhood Education , 4 (1), 295–301.
14. Ilma, AZ, Wilujeng, I., Widowati, A., Nurtanto, M., & Kholifah, N. (2023). A Systematic Literature Review of STEM Education in Indonesia (2016-2021): Contribution to Improving Skills in 21st Century Learning. Pegem Egitim ve Ogretim Dergisi, 13 (2), 134–146. https://doi.org/10.47750/pegegog.13.02.17.
15. Supriyadi, E., Turmudi, Dahlan, JA, & Juandi, D. (2023). Publication Trends from STEAM in Education from Scopus Database: Bibliometric Analysis. Journal of Science Education Research , 9 (6), 104–111. https://doi.org/10.29303/jppipa.v9i6.3576.
16. Wulandari, AP, Salsabila, AA, Cahyani, K., Nurazizah, TS, & Ulfiah, Z. (2023). The Importance of Learning Media in the Teaching and Learning Process. Journal on Education , 5 (2), 3928–3936. https://doi.org/10.31004/joe.v5i2.1074.
17. Anisabela, M., & Rahminawati, N. (2022). Using Loose Parts Media to Develop Children's Ability to Understand Size Concepts. Unisba Press PAUD Teacher Education Research Journal , 2 (1), 47–52. https://doi.org/https://doi.org/10.29313/jrpgp.vi.896
18. Muntomimah, S., & Wijayanti, R. (2021). The Importance of STEAM Loose Part Learning Effectiveness in Early Childhood Cognitive Learning. Proceedings of the 2nd Annual Conference on Social Science and Humanities (ANCOSH 2020) , 542 (Ancosh 2020), 47–52. https://doi.org/10.2991/assehr.k.210413.012.
19. Rahardjo, MM (2019). How to use Loose-Parts in STEAM? Early Childhood Educators Focus Group discussion in Indonesia. JPUD - Journal of Early Childhood Education , 13 (2), 310–326. https://doi.org/10.21009/jpud.132.08.
20. Ratna, A., Arbarini, M., & Loretha, AF (2023). STEAM Learning with Loose Parts Media in Early Childhood Playgroups . 7 (3), 3227–3240. https://doi.org/10.31004/obsesi.v7i3.4468.
21. Hapidin, Gunarti, W., Pujianti, Y., & Siti Syarah, E. (2020). STEAM to R-SLAMET Modification: An Integrative Thematic Play Based Learning with R-SLAMETS Content in Early Childhood Education. JPUD - Journal of Early Childhood Education , 14 (2), 262–274. https://doi.org/10.21009/jpud.142.05.
22. Putri, SU, & Taqiudin, AA (2021). Steam-PBL: Strategy for Developing Problem Solving Abilities in Early Childhood. Obsession Journal: Journal of Early Childhood Education , 6 (2), 856–867..

23. Hapidin, Pujianti, Y., Syarah, ES, & Gunarti, W. (2023). Teacher's Understanding of Project Learning Models through Children's Comics with STEAM Content in Indonesia. JPUD - Journal of Early Childhood Education , 17 (1), 82–97. https://doi.org/10.21009/jpud.171.06.
24. Khine, M. S., & Areepattamannil, S. (2019). STEAM Education: Theory and Practice. In STEAM Education: Theory and Practice . https://doi.org/10.1007/978-3-030-04003-1.
25. Wahyuningsih, S., Nurjanah, NE, Rasmani, UEE, Hafidah, R., Pudyaningtyas, AR, & Syamsuddin, MM (2020). STEAM Learning in Early Childhood Education: A Literature Review. International Journal of Pedagogy and Teacher Education , 4 (1), 33. https://doi.org/10.20961/ijpte.v4i1.39855.
26. Budiyanto, CW, Shahbodin, F., Umam, MUK, Isnaini, R., Rahmawati, A., & Widiastuti, I. (2021). Developing Computational Thinking Ability in Early Childhood Education: The Influence of Programming-toys on Parent-Children Engagement. International Journal of Pedagogy and Teacher Education , 5 (1), 19. https://doi.org/10.20961/ijpte.v5i1.44397.
27. Kurniasih, E., Amini, M., & Haryati, Y. (2022). Design of a Virtual Laboratory Based on Virtual Reality for Learning Resources in Early Childhood Learning. KnE Social Sciences , 2022 , 1062–1070. https://doi.org/10.18502/kss.v7i14.12056.
28. Sit, M., & Rakhmawati, F. (2022). Development of Learning Models for Science, Technology, Engineering, Arts, and Mathematics in Early Childhood. Obsession Journal: Journal of Early Childhood Education , 6 (6), 6813–6826. https://doi.org/10.31004/obsessi.v6i6.3496
29. Mariano, W. K., & Chiappe, A. (2021). 21st-century skills and their relationship to STEAM learning environments: a review. Revista de Educación a Distancia (RED) , 21 (66), 1–22. https://doi.org/10.6018/red.470461
30. Pramudyani, AVR, & Indratno, TK (2022). Understanding Science, Technology, Engineering, Art and Mathematics (STEAM) in PAUD Teacher Candidates. Obsession Journal: Journal of Early Childhood Education , 6 (5), 4077–4088. https://doi.org/10.31004/obsesi.v6i5.2261
31. Suryaningsih, A., Cahaya, IME, & Poerwati, CE (2023). Implementation of the Steam-Based Quantum Learning Model on Problem Solving Ability. Journal of Obsession: Journal of Early Childhood Education , 7 (2), 1887–1896. https://doi.org/10.31004/obsesi.v7i2.4299
32. Yanuartini Rahayu, E., Nurani, Y., & Martini Meilanie, S. (2023). STEAM-inspired Learning: Cultivating Critical Thinking Skills through Video Tutorials. Obsession Journal: Journal of Early Childhood Education , 7 (3), 2627–2640. https://doi.org/10.31004/obsessi.v7i3.4228