

## Transforming Teak Branch Waste into Applied Art: Development Eco-Art Learning Module for Junior High School Students

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### ABSTRACT

Arts education in Indonesian schools is often constrained by a reliance on synthetic, non-biodegradable materials and a shortage of contextual instructional resources, limiting student exploration of local media. This study addresses these gaps through the design, validation, and field evaluation of a structured eco-art learning module that guides ninth-grade students in transforming abundant, underutilized teak (*Tectona grandis*) branch waste in South Sulawesi into functional applied-art products. Developed using the five-phase ADDIE framework, the module's content and media validity were evaluated by four experts. A field trial was then conducted at Junior High School 6 Binamu using validation sheets, student questionnaires, and performance-based artwork assessments. Expert evaluations rated the module as highly feasible, yielding mean validity indices of 88.3% for content and 86.6% for media. In field trials, the mean student response score reached 87.5%, and 90% of participants met or exceeded minimum mastery criteria across technical and creative dimensions. Qualitatively, the module facilitated a pedagogical shift from teacher-centered demonstration to student-centered facilitation, while substituting forestry waste for commercial supplies reduced material costs by approximately 70%. The findings demonstrate that hard organic forestry waste serves as a pedagogically viable, economically resilient medium for applied-art instruction. Furthermore, a well-scaffolded module can foster learner autonomy while advancing environmental sustainability in education. Although limited by a single-school sample without a control group, these formative results warrant broader, comparative validation.

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## 1. INTRODUCTION

Arts, culture, and crafts education at the junior secondary level plays a formative role in cultivating students' character, aesthetic sensibility, and creative capacity (Fakhrudinova et al., 2017). Far from being a matter of drawing or colouring alone, the visual arts function as a strategic medium for developing visual sensitivity, spatial

reasoning, and problem-solving through the iterative process of artistic making (Mohamed & Kamel, 2024). Within Indonesia's Kurikulum Merdeka (Independent Curriculum) and its emphasis on strengthening the Pancasila Student Profile, arts education is increasingly expected to be contextual and project-based and to bring global concerns such as environmental sustainability into the classroom (Asmi et al., 2025; Sari et al., 2026).

This expectation, however, is frequently unmet in practice. Visual-arts instruction often remains anchored in theoretical routines or conventional exercises that depend on manufactured inputs such as poster paint, canvas, and plastic (Wu & Hedges, 2026). Such materials are comparatively costly and, when consumed continuously, environmentally burdensome. This dependence introduces a psychological and physical distance between students and the authentic materials of their own surroundings, eroding their sensitivity to local knowledge and ecological context (Ramadhanti et al., 2026). The problem is compounded where dedicated teaching materials are scarce: in the absence of structured guidance, learners habituated to teacher-centered instruction struggle to generate original ideas, with measurable consequences for engagement and psychomotor attainment (Rahayu, 2014).

Junior High School 6 Binamu, in the Jeneponto Regency of South Sulawesi, exemplifies both the constraint and the opportunity. The school is situated in an area with ready access to plantation and forestry residues, teak (*Tectona grandis*) chief among them, yet its ninth-grade applied-arts instruction continues to rely on conventional media. Teak branch and twig waste is widely treated locally as firewood or valueless organic refuse, despite physical properties—strong fibres, an attractive natural colour, and considerable weather resistance—that make it well suited to craft applications. In applied-art terms, such material affords substantial flexibility for conversion into functional, marketable products including lamp bases, photo frames, wall hangings, and miniature furniture (Azhar et al., 2025).

Repurposing this waste is not merely an aesthetic exercise; it is a concrete enactment of eco-art education—an orientation that connects artistic practice to ecological awareness and to the circulation of materials within a community (Fan, 2025; Sunassee et al., 2021). Teaching students to convert discarded matter into valued objects operationalises the principle of upcycling: a systematic increase in the utility and economic value of used goods (Burns, 2024; Shamshad et al., 2026). This concern is shared internationally; recent reviews position the arts as a vehicle through which young people become "experts on their own environment" and develop ecological citizenship, and they document a steady growth of arts-based and sustainability-competence programmes in secondary schooling over the past two decades (Bravo-Fuentes et al., 2025).

Realising these aims in the classroom depends on the quality of the guiding materials. A module is a self-contained learning package, systematically designed so that students can attain specified competencies with minimal direct assistance from the teacher (Bautista et al., 2016; Mohammad et al., 2025). The materials currently available at Junior High School 6 Binamu are general and text-heavy, and do not address the

practical demands of working with local waste. A purpose-built module that sequences branch selection, cleaning, cutting, joining, and finishing can render the psychomotor learning process more flexible and more measurable, allowing learners to progress at their own pace.

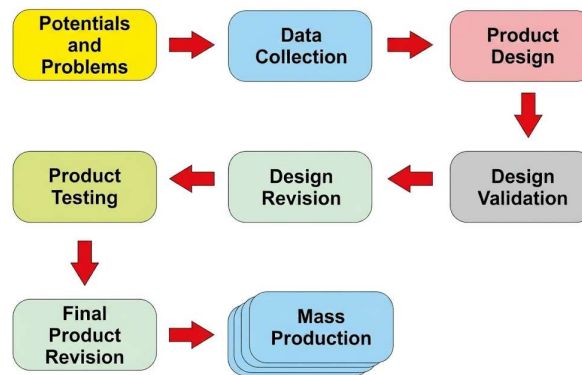
Three features distinguish the present study from prior development research. First, where most visual-arts development work employs synthetic or generic natural materials (Fajrie et al., 2024), this study specifically exploits teak branch waste—abundant in Binamu yet rarely incorporated into formal school curricula. Second, the module is not merely technical and procedural; it embeds a zero-waste philosophy directly within applied-arts practicum instruction, aligning material choice with ecological intent. Third, the design is calibrated to the concrete circumstances of Junior High School 6 Binamu—the motor-skill profile of its students and the equipment available in its art workshop—and is oriented toward applied rather than purely expressive art, thereby cultivating an entrepreneurial disposition through waste processing. Accordingly, this study addresses three research questions:

1. RQ1. Is an applied-art learning module based on teak branch waste valid in content and media terms, as judged by subject-matter and instructional-media experts?
2. RQ2. Is the module practical in authentic classroom use, as indicated by student responses and by students' capacity to produce applied-art works?
3. RQ3. What are the module's perceived effects on learner autonomy, the teacher's instructional role, and the cost of practicum materials?

To answer these questions, the study employs a Research and Development (R&D) methodology by Borg & Gall (Sari & Dwikurnaningsih, 2025; Siregar, 2023; Untoroso & Triayudi, 2023), chosen because the aim is to resolve a practical classroom problem by producing a tangible artefact that has passed through expert validation and successive trials. A structured development model permits the resulting module to be evaluated against recognised academic and practical quality criteria (Plomp & Nieveen, 2013). The remainder of the article describes the method, reports the validation and field-trial results, situates the findings within the eco-art and instructional-design literatures, and acknowledges the study's limitations.

## 2. METHOD

This study adopted a Research and Development (R&D) approach, which is used to generate a specific product and to examine its quality in use. The ADDIE model structured the work into five sequential phases—Analysis, Design, Development, Implementation, and Evaluation—each of which fed forward into the next through cycles of revision. Figure 1 summarises the procedural flow from the identification of needs and potential through to a validated, field-tested product.



**Figure 1.** Stages of the Research and Development (R&D) Procedure

The Analysis phase characterised the learning needs of ninth-grade students at Junior High School 6 Binamu, examined the demands of the applied-arts curriculum, and surveyed the availability of teak branch waste in the surrounding environment. The Design phase translated these findings into a module blueprint comprising learning objectives, a content framework, project worksheets, and assessment instruments. In the Development phase, the module was produced in print and digital form and submitted to expert validation; feedback was used to revise the draft prior to use. The Implementation phase comprised a classroom trial intended to gauge practicality in authentic conditions, and the Evaluation phase analysed the module's perceived effects on students' independence and technical understanding and confirmed that the development objectives had been met.

Two participant groups were involved. The validation panel comprised four experts: two subject-matter specialists in fine art, who appraised the accuracy and depth of the content, and two instructional-media specialists, who appraised visual design, layout, typography, and readability. The field-trial participants were ninth-grade students enrolled in Arts and Culture at Junior High School 6 Binamu, who used the module during regular lessons and produced applied-art works for assessment. Participation was voluntary, and data were collected and reported in aggregate; no individually identifying information is presented.

Three instruments were used. (i) Expert validation sheets captured ratings across content, presentation, language, and graphic dimensions on a Likert scale, together with open-ended comments. (ii) A student-response questionnaire assessed the module's practicality and ease of use. (iii) A performance-based assessment, implemented through an observation sheet and product rubric, evaluated students' psychomotor competence in producing applied-art works from teak branches, with explicit attention to both aesthetic and functional quality. Qualitative data—suggestions, criticism, and recommendations from validators and respondents—were recorded alongside the quantitative ratings to inform revision.

Quantitative data were analysed descriptively. Likert-scale ratings from the validation sheets and the response questionnaire were converted to percentages using

$$P = (f / N) \times 100\%$$

Where P is the achieved percentage, f the total score obtained, and N the maximum possible score. Following established criteria for design-and-development research, a product was deemed to satisfy the feasibility threshold at a minimum of 75% and to be "highly feasible" above 80%. Qualitative comments were examined thematically and mapped onto specific revisions of the module. Validity was operationalised through the expert ratings (RQ1); practicality through the student-response questionnaire and the proportion of students meeting the minimum mastery criterion (RQ2); and perceived effects through triangulated observation and respondent feedback (RQ3).

### 3. RESULTS AND DISCUSSION

#### Results

This section presents the outcomes of each ADDIE phase, from needs analysis to the evaluation of effectiveness, focusing on the validation and field-trial evidence that bears on the three research questions.

#### Analysis Phase

The needs analysis indicated that ninth-grade students were strongly disposed toward hands-on learning, but that the cost of conventional materials frequently impeded practical work. Curriculum analysis showed that attaining the basic applied-arts competencies required more specific instructional media—in particular, detailed visualisation of wood-joining techniques to support students' technical understanding. These needs converged with an environmental opportunity: an abundant local supply of teak branch waste, hitherto treated as organic refuse. Integrating this material into instruction promised to address the cost barrier while creating a vehicle for locally grounded, sustainability-oriented learning.

#### Design Phase

The design phase produced a complete module structure. It opened with a cover and an introduction setting out the learning objectives, followed by a concept map serving as an advance organiser (Figure 3). The core content consolidated students' understanding of the distinctive characteristics of teak branches and introduced basic woodworking tools, establishing a technical foundation prior to the practical stages. Project worksheets then provided step-by-step guidance for producing functional items such as pencil holders, photo frames, and decorative lamps. To gauge attainment, the module included an objective assessment rubric addressing both the aesthetic and functional qualities of the finished work. Figure 2 shows the final module cover.



Figure 2. Cover of the developed applied-art learning module, “Creating Applied Art from Teak Branch Waste.”



Figure 3. Concept map used as an advanced organizer

### Development Phase

During development, the module draft was produced and then submitted to expert validation to confirm its suitability in both content and media terms. The draft content emphasised the identification of natural materials, the function of basic tools, and core

making techniques—joining, arranging, and finishing—illustrated through worked examples (Figures 4 and 5).



Figure 4. Core content pages introducing the concept and characteristics of applied art using natural and waste materials



Figure 5. Learning Activity 2 — identifying materials, tools, and basic making techniques for working with teak branches.

### Subject-Matter Expert Validation

Two fine-art specialists evaluated the depth of content and the accuracy of the techniques presented. As shown in Table 1, all assessed dimensions were rated in the "highly feasible" range, with an overall mean of 88.3%.

**Table 1.** Results of subject-matter expert validation

Assessment dimension	Mean score (%)	Category
Content suitability	88	Highly feasible
Coverage of practical material	92	Highly feasible
Curriculum compliance	85	Highly feasible
Overall mean	88.30	Highly feasible

### Instructional-Media Expert Validation

Two media specialists examined layout design, the quality of the instructional images, and typographic readability. Table 2 reports an overall mean of 86.6%, again within the "highly feasible" range.

**Table 2.** Results of instructional-media expert validation

Assessment dimension	Mean score (%)	Category
Graphic design and layout	90	Highly feasible
Quality of instructional photographs	86	Highly feasible
Language readability	84	Highly feasible
Overall mean	86.60	Highly feasible

In response to validator feedback, close-up photographs of the sanding and gluing procedures were added so that students could more readily understand the junction points between branches. This revision directly addressed the media panel's readability comments and the subject-matter panel's emphasis on technical clarity.

### Implementation Phase

Once judged feasible, the module was trialled with ninth-grade students at Junior High School 6 Binamu to assess practicality and effectiveness in authentic lessons. Evidence was drawn from the student-response questionnaire and from direct observation of the resulting artworks. Figure 6 illustrates the practical activity in which students applied the module's procedures to convert teak branches into finished products.



**Figure 6.** Students apply the module's procedures (designing, joining, sanding, and finishing) to create applied-art works from teak branch waste

The trial yielded positive results. The mean student-response score was 87.5%, indicating that students found the module effective in supporting independent understanding of the waste-processing sequence. Observation of finished work corroborated this: 90% of students met or exceeded the minimum mastery criterion across both technical and creative dimensions. Table 3 summarises these outcomes.

**Table 3.** Implementation of outcomes and student responses

Dimension	Indicator	Result	Category
Student response	Ease of use and independence with the module	87.50%	Highly practical
Product (psychomotor)	Students meeting/exceeding minimum mastery (technical and creative)	90%	Very high

Taken together, the data indicate that the module was not only well received in terms of usability but also associated with substantial practical competence in converting waste into applied-art products.

### Evaluation Phase

The concluding evaluation pointed to three converging effects. First, using teak branch waste as the primary medium was associated with a shift in students' perception of waste—from valueless refuse to a resource with aesthetic and economic worth—suggesting that environmentally grounded materials can foster ecological awareness and contextual creativity. Second, the structured guidance reduced students' reliance on repeated verbal instruction, moving the lesson toward a more student-centred mode and

freeing the teacher to act as facilitator and mentor with more individualised, higher-quality feedback. Third, substituting waste for manufactured synthetic supplies reduced practicum material costs by an estimated 70%. Overall, the module was judged highly feasible and practical for use at SMPN 6 Binamu, bridging applied-art theory and practice while reinforcing a locally grounded learning identity.

## **Discussion**

### **Validity and Practicality of the Module**

The module was rated "highly feasible" by both subject-matter (88.3%) and media (86.6%) experts, indicating that it satisfies recognised criteria of intrinsic instructional quality. A sound module as self-contained—enabling students to master competencies without being wholly dependent on the teacher (Aisyah et al., 2023; Mohammad et al., 2025). Clear navigation, a coherent visual layout, and a systematic breakdown of tasks allow the module to function as an autonomous learning tool (Qin et al., 2024). The favourable implementation result (87.5%) further suggests that such a module can enhance the effectiveness of practical learning, echoing Maksun and Purwanto (2022) finding that project-based modules improve psychomotor skills relative to conventional demonstration. In cognitive terms, the module acts as a bridge from a theoretical understanding of waste to the practical production of complex works: by sequencing the procedure into well-structured visual steps, it helps students avoid cognitive overload and engage directly in the tactile and spatial manipulation that making demands (Sweller, 2016).

### **Local Materials and Eco-Art Education**

A central finding is that students were able to transform teak branch waste into functional, aesthetically satisfying products. This enacts the eco-art education principle that arts learning should connect students to their natural environment and thereby build ecological awareness (Fan, 2025; Ison & Bramwell-Lalor, 2024). By collecting and processing forestry waste, students developed a grounded sense of resource circularity within their immediate surroundings. The rough texture and irregular form of teak branches also pose a creative challenge distinct from that of uniform manufactured materials—conditions that, as Irvan et al. (2024) and Mutmainah et al. (2024) reports for wood waste in craft learning, can stimulate divergent thinking. At Junior High School 6 Binamu, working with teak branches not only lowered operational costs but also fostered pride in local resources, which lies at the heart of contextual teaching and learning. The estimated 70% reduction in material costs is significant for schools facing financial and infrastructural constraints, supporting the contention that high-quality arts education need not depend on expensive, non-biodegradable synthetic supplies (Marqués Ibáñez, 2023; Pavlou & Castro-Varela, 2024; Pavlou & Vella, 2023).

### **Teacher Role and Learner Autonomy**

The module reshaped classroom dynamics. Rather than serving as the sole source of technical instruction, the teacher moved toward a facilitative, mentoring role—an

arrangement well described by Vygotsky's Zone of Proximal Development, in which the module operates as scaffolding that enables students to reach higher levels of competence with reduced direct support (Huang & Chen, 2025; Lim et al., 2023). When the module assumes responsibility for repetitive, low-level explanation, the teacher is freed to offer higher-quality, individualised feedback and to support students through specific creative obstacles (Bürgermeister et al., 2021; Demszky et al., 2025). The module's visual treatment of joining and finishing techniques also helps minimise the technical errors common in woodworking. The autonomy it cultivates is closely aligned with the Kurikulum Merdeka's emphasis on independent learning and the exploration of students' interests and talents, and with the self-regulation that underpins lifelong learning (Gupta et al., 2024; Reeve & Cheon, 2021).

### **Theoretical and Practical Contributions**

Theoretically, the study extends the literature on visual-arts instructional media by demonstrating that hard organic waste—specifically teak branches—can be integrated into a structured module without compromising the aesthetic or academic value of arts learning, thereby offering a basis for incorporating forestry residues into formal curricula. Practically, it provides a concrete response to the constraints of limited funding and scarce practicum materials: the module functions as a prototype that other schools can adapt to their own local materials. More broadly, the work contributes to the zero-waste movement in education by reframing the school community's perception of waste from "refuse" to "creative resource".

### **Limitations**

Several limitations qualify these conclusions and should guide their interpretation. First, the evaluation was conducted in a single school and did not employ a control or comparison group; the effectiveness evidence is therefore formative rather than confirmatory, and causal claims cannot be made. Second, the practicality and effect measures relied substantially on self-reported student responses and on observer-rated products, both of which are susceptible to social-desirability and rater effects; inter-rater reliability for the product rubric was not formally quantified. Third, the 70% cost reduction is an operational estimate specific to this setting and does not account for the time and labour involved in collecting and preparing the waste material. Fourth, the study measured immediate outcomes only, leaving the durability of the learning, its transfer to other materials, and any longer-term entrepreneurial effects unexamined. These constraints are common in school-based design research but nonetheless bound the generality of the findings.

## **4. CONCLUSION**

This study designed, validated, and field-tested an applied-art learning module that guides ninth-grade students in transforming teak branch waste into functional artworks. Experts judged the module "highly feasible" in both content and media terms, with mean validity indices above 85%, indicating that it meets recognised standards for content,

presentation, language, and graphics as a formal teaching resource (RQ1). In authentic classroom use it proved highly practical (87.5%), with 90% of students meeting or exceeding the minimum mastery criterion (RQ2). The module was further associated with greater learner autonomy in processing waste into functional works, a shift in the teacher's role from instructor to facilitator, and an estimated 70% reduction in practicum costs through the use of local materials (RQ3). In bridging applied-art theory and practice, it enabled students to acquire basic woodworking skills while developing ecological awareness through the upcycling of teak branch waste.

Because the evidence derives from a single school without a comparison group, these conclusions are best read as a well-supported proof of concept rather than a definitive demonstration of effectiveness. Future research should test the module across multiple schools, ideally with a comparison condition and pre- and post-measures of psychomotor and creative attainment, and should formally establish the reliability of the assessment instruments. Integrating an explicit entrepreneurial component—so that students' work is both aesthetically and commercially viable—and facilitating the publication or exhibition of student work would further strengthen the model. More broadly, the module offers a replicable prototype for locally grounded, economical, and sustainability-oriented arts education that other schools in comparable settings can adapt to the natural materials available to them.

## REFERENCES

- Aisyah, S., Saputra, D., Khairi, A. I., & Asa, F. O. (2023). Learning Media Validity Based On Interactive Module Digital On Batik Materials In Fine Arts Education Program. *Eleventh International Conference on Languages and Arts (ICLA 2022)* (pp. 139-145). Atlantis Press. [https://doi.org/10.2991/978-2-38476-124-1\\_21](https://doi.org/10.2991/978-2-38476-124-1_21)
- Asmi, Y. K., Wibawa, S., Barriyah, I. Q., Nisa, A. F., & Zulfiati, H. M. (2025). Development of PJBL and Deep Learning to improve student creativity in Pancasila integrated arts education. *Sosioedukasi: Jurnal Ilmiah Ilmu Pendidikan dan Sosial*, *14*(2), 832-846. <https://doi.org/10.36526/sosioedukasi.v14i1.5619>
- Azhar, H., Putri, A. S., & Neo, M. (2025). Sustainable Design with Circular Thinking: Reinventing Teak Wood Waste into Decorative Products. *Architecture Image Studies*, *6*(4), 1038-1044. <https://doi.org/10.62754/ais.v6i4.716>
- Bautista, A., Tan, L. S., Ponnusamy, L. D., & Yau, X. (2016). Curriculum integration in arts education: connecting multiple art forms through the idea of 'space'. *Journal of Curriculum Studies*, *48*(5), 610-629. <https://doi.org/10.1080/00220272.2015.1089940>
- Bravo-Fuentes, P., Albusac-Jorge, M., & López-Peláez Casellas, M. P. (2025). Music and art as a hubs for transdisciplinarity: Toward the achievement of the Sustainable Development Goals. *Arts Education Policy Review*, *126*(4), 218-226. <https://doi.org/10.1080/10632913.2025.2451372>
- Burns, A. (2024). Upcycling classics—sustainable design development through fabric manipulation techniques in fashion design education. *International Journal of Art & Design Education*, *43*(2), 272-288. <https://doi.org/10.1111/jade.12502>
- Bürgermeister, A., Glogger-Frey, I., & Saalbach, H. (2021). Supporting peer feedback on learning strategies: Effects on self-efficacy and feedback quality. *Psychology Learning & Teaching*, *20*(3), 383-404. <https://doi.org/10.1177/14757257211016604>

- Demszky, D., Liu, J., Hill, H. C., Sanghi, S., & Chung, A. (2025). Automated feedback improves teachers' questioning quality in brick-and-mortar classrooms: Opportunities for further enhancement. *Computers & Education*, 227, 105183. <https://doi.org/10.1016/j.compedu.2024.105183>
- Fajrie, N., Kartika, D. D., Utaminingsih, S., & Santoso, D. A. (2024). Natural material-based art learning model increases aesthetic experiences in early childhood. *Jurnal Pendidikan Anak Usia Dini Undiksha*, 12(1), 109-119. <https://ejournal.undiksha.ac.id/index.php/JJPAUD/article/view/74612>
- Fakhrudinova, A. V., Kadyjrova, L. H., & Musina, K. İ. (2017). Artistic and aesthetic education of students by the means of the national arts and crafts: the Tatarstan republic experience. *IJAEDU-International E-Journal of Advances in Education*, 3(8), 268-273. <https://doi.org/10.18768/ijaedu.336250>
- Fan, H. (2025). Integrating ecological consciousness into environmental art design education: Impacts on student engagement, sustainability practices, and critical thinking. *Sustainable Development*, 33(5), 6549-6572. <https://doi.org/10.1002/sd.3474>
- Gupta, N., Ali, K., Jiang, D., Fink, T., & Du, X. (2024). Beyond autonomy: unpacking self-regulated and self-directed learning through the lens of learner agency-a scoping review. *BMC medical education*, 24(1), 1519. <https://doi.org/10.1186/s12909-024-06476-x>
- Huang, W. H., & Chen, H. L. (2025). Developing a Disaster Literacy Curriculum for Young Children: Integrating Social Learning Theory and the Zone of Proximal Development. *Early Childhood Education Journal*, 1-25. <https://doi.org/10.1007/s10643-025-02049-9>
- Irvan, M., Eka, A., Setyaningsih, N., Fuad, H., & Mustika, D. (2024). Utilization of Wood Waste as Learning Media for Children with Special Needs. *Special and Inclusive Education Journal (SPECIAL)*, 5(1), 23-27. <https://doi.org/10.36456/special.vol5.no1.a9124>
- Ison, M., & Bramwell-Lalor, S. (2024). The arts in environmental education: connecting learners with their talents and nature. In *Environmental and Sustainability Education (ESE) in the English-Speaking Caribbean* (pp. 80-95). Routledge. <https://doi.org/10.4324/9781003581772-6>
- Lim, K. Y., Njondimackal, D. J., & Lok, J. B. (2023). Conceptualising, Designing and Enacting a Zone of Proximal Development for an After-School Coding Curriculum. In *Moving Beyond Grades to Purposeful Learning: Lessons from Singaporean Research* (pp. 113-125). Singapore: Springer Nature Singapore. [https://doi.org/10.1007/978-981-99-4705-8\\_7](https://doi.org/10.1007/978-981-99-4705-8_7)
- Maksum, H., & Purwanto, W. (2022). The Development of Electronic Teaching Module for Implementation of Project-Based Learning during the Pandemic. *International Journal of Education in Mathematics, Science and Technology*, 10(2), 293-307. <https://doi.org/10.46328/ijemst.2247>
- Marqués Ibáñez, A. M. (2023). Art education through the sustainable design of learning spaces. *International Journal of education through art*, 19(1), 113-133. [https://doi.org/10.1386/eta\\_00122\\_1](https://doi.org/10.1386/eta_00122_1)
- Mohamed, F., & Kamel, T. (2024). Aesthetic Transfer in Modern Visual Arts Education: Emphasizing 'Learning by Making' and Experimental Approaches for Future Creative Success. *JES. Journal of Engineering Sciences*, 52(6), 757-771. [https://jesaun.journals.ekb.eg/article\\_386695.html](https://jesaun.journals.ekb.eg/article_386695.html)
- Mohammad, F., Ladin, C. A., & Shaharom, M. S. N. (2025). Module development for effective teaching and learning in Art Education: A Narrative review. *KUPAS SENI:*

- Jurnal Seni Dan Pendidikan Seni*, 13(2), 21-44.  
<https://doi.org/10.37134/kupaseni.vol13.2.3.2025>
- Mutmainah, A., Suminar, T., & Setiawan, D. (2024). Implementation Of The Use Of Educational Game Tools (Clogs) From Wood Waste To Develop Creativity. *International Journal Of Research*, 11(12), 77-85.  
<https://elibrary.ru/item.asp?id=79854112>
- Pavlou, V., & Castro-Varela, A. (2024). E-learning canvases: Navigating the confluence of online arts education and sustainable pedagogies in teacher education. *Sustainability*, 16(5), 1741. <https://doi.org/10.3390/su16051741>
- Pavlou, V., & Vella, R. (2023). Art, sustainability and partnerships. *International Journal of Education Through Art*, 19(1), 3-10. [https://doi.org/10.1386/eta\\_00114\\_2](https://doi.org/10.1386/eta_00114_2)
- Plomp, T., & Nieveen, N. (2013). Educational design research educational design research. *Netherlands Institute for Curriculum Development: SLO*, 153, 152-169.
- Qin, Y., Hu, S., Lin, Y., Chen, W., Ding, N., Cui, G., ... & Sun, M. (2024). Tool learning with foundation models. *ACM Computing Surveys*, 57(4), 1-40.  
<https://doi.org/10.1145/3704435>
- Rahayu, K. (2014). Pembelajaran Seni Kriya Bambu Hias Pada Siswa Kelas VII A SMP N 1 Wadaslintang Kabupaten Wonosobo. *Eduarts: Jurnal Pendidikan Seni*, 3(1).  
<https://journal.unnes.ac.id/sju/eduart/article/view/4056>
- Ramadhanti, A., Susanti, A., & Sari, R. (2026). Eksistensi Teknik Patchwork dalam Pembelajaran Seni dengan Sumber Ide Kearifan Lokal Batik Besurek Bengkulu pada Mahasiswa PGSD. *Prosiding Seminar Nasional FKIP Universitas Muslim Maros* (Vol. 3, No. 1, pp. 72-81).  
<https://ejournals.umma.ac.id/index.php/semnas/article/view/3322>
- Reeve, J., & Cheon, S. H. (2021). Autonomy-supportive teaching: Its malleability, benefits, and potential to improve educational practice. *Educational psychologist*, 56(1), 54-77. <https://doi.org/10.1080/00461520.2020.1862657>
- Sari, Y. N., & Dwikurnaningsih, Y. (2025). Development of a TPACK training module through AI integration to improve the pedagogical skills of arts teachers. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran, dan Pembelajaran*, 11(3), 1293-1303.  
<https://doi.org/10.33394/jk.v11i3.16145>
- Sari, A. T. R., & Wahyudi, W. (2026). Transforming the Arts Education Curriculum as a Strategy for Strengthening 21st-Century Competencies: A Comparative Study of Indonesia and Singapore. *Jurnal Pendidikan Dasar Nusantara*, 11(2), 250-269.  
<https://ojs.unpkediri.ac.id/index.php/pgsd/article/view/27974>
- Shamshad, A., Hameed, A., & Naz, U. (2026). Sustainability in Practice: Furniture Upcycling as A Pedagogical Framework for Circular Design Education. *Social Science Review Archives*, 4(1), 66-83.  
<https://policyjournalofms.com/index.php/6/article/view/1491>
- Siregar, T. (2023). Stages of research and development model research and development (R&D). *DIROSAT: Journal of Education, Social Sciences & Humanities*, 1(4), 142-158. <https://doi.org/10.58355/dirosat.v1i4.48>
- Sunasee, A., Bokhoree, C., & Patrizio, A. (2021). Students' empathy for the environment through eco-art place-based education: A review. *Ecologies*, 2(2), 214-247.  
<https://doi.org/10.3390/ecologies2020013>
- Sweller, J. (2016). Working memory, long-term memory, and instructional design. *Journal of Applied Research in Memory and Cognition*, 5(4), 360-367.  
<https://doi.org/10.1016/j.jarmac.2015.12.002>

- Untoroseto, D., & Triayudi, A. (2023). Analysis of blended learning development in distance learning in variation of Borg & Gall and ADDIE models. *Journal La Multiapp*, 4(6), 231-242. <https://doi.org/10.37899/journallamultiapp.v4i6.973>
- Wu, T., & Hedges, H. (2026). Teachers' perceptions and practices of iPads for visual arts learning in early childhood education. *Journal of Research on Technology in Education*, 58(2), 381-395. <https://doi.org/10.1080/15391523.2024.2425439>