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Designing Project-Based Multimedia for Vocational Fashion Education: Component-Level Validation and Student Creativity in Support of Sustainable Development Goals

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DOI : <https://doi.org/10.63230/jocsis.3.4.337>

Sections Info

Article history:

Submitted: March 8, 2026
Final Revised: August 21, 2026
Accepted: August 31, 2026
First Available Online: September 29, 2026
Publication Date: December 27, 2027

Keywords:

Multimedia Design;
Project-Based Learning;
Student Creativity;
Sustainable Development Goals;
Vocational Fashion Education.

ABSTRACT

Objective: To design and validate a three-component project-based multimedia package for children's-wear sewing in vocational fashion education, and examined its component-level feasibility, classroom practicality, implementation fidelity, and student creativity. **Method:** An ADDIE design-and-development study was conducted with Grade XI fashion students at two state vocational schools in Pamekasan, Indonesia. Five experts rated the video tutorial, the e-module, and the interactive presentation separately; three observers scored 23 implementation indicators across the six PjBL phases; 180 students and three practitioners rated practicality; creativity was assessed through fluency, flexibility, originality, and elaboration in the finished garment; and learning outcomes were measured in a one-group pretest-posttest design ($n = 120$). **Results:** Component ratings were uniformly very feasible but not identical: e-module 3.96, video tutorial 3.92, and interactive presentation 3.80 on a four-point scale. All 23 indicators were observed in all six phases. Students rated the package 3.62 of 4.00 and practitioners 91.67%. Creativity was high for 70.83% of students ($M = 90.00$). Cognitive mastery rose from 15% to 90%, $t(119) = -44.90$, $p < .001$, with an N-gain of 0.81. **Novelty:** Validate each medium separately rather than as an undifferentiated package, showing that the three media carry distinct instructional loads across the project cycle, and positions vocational fashion multimedia explicitly within SDG 4 Target.

INTRODUCTION

Vocational fashion education asks students to do three things at once: understand design principles, translate an idea into a workable plan, and execute that plan with a needle, a machine, and a length of fabric. A garment is judged not by what the student knows but by what the student has made. This makes the subject unusually demanding to teach. Explanation alone leaves students unable to execute; unguided practice leaves them unable to plan, diagnose a fault, or justify a design decision. The instructional problem is therefore not whether to add technology, but how to arrange technology, project work, and feedback so that each carries the part of the task it is best suited to.

This is also a sustainability question. Sustainable Development Goal (SDG) 4 commits states to inclusive and equitable quality education, and Target 4.4 specifies an increase in the number of young people holding relevant technical and vocational skills for employment and decent work. Indonesian vocational secondary schools are the main institutional route to that target in the garment sector, yet the quality of instruction inside them varies widely with teacher expertise, workshop facilities, and the media available in the classroom (Hiim, 2023; Kamaludin et al., 2022; Lewis, 2025). Improving the instructional resources of these schools is one of the more direct levers available for Target 4.4.

Project-Based Learning (PjBL) is a plausible structure for this kind of teaching because it organises knowledge around an extended task that ends in a product.

Foundational accounts emphasise a driving question, learner decision-making, sustained inquiry, collaboration, monitoring, and reflection (Blumenfeld et al., 1991), and reviews associate PjBL with gains in achievement, engagement, and higher-order thinking, though with effects that depend heavily on implementation quality (Chen & Yang, 2019; Guo et al., 2020; Kokotsaki et al., 2016; Loyens et al., 2023; Sukacke et al., 2022). In vocational settings the dependence is sharper still, because the process of making is itself the competence being assessed (Orozco et al., 2019; Schaap et al., 2012; Yusop et al., 2022). Recent Indonesian work reports that PjBL raises both creativity and learning outcomes in vocational classrooms (Kristiana et al., 2025; Muhtar et al., 2025; Suwarno et al., 2020).

Multimedia can strengthen PjBL where a process is hard to convey in words (Abdulrahman et al., 2020; Almufarreh & Arshad, 2023). The cognitive theory of multimedia learning holds that coordinated verbal and visual representations support understanding when they are designed to manage processing rather than merely to decorate (Cavanagh & Kiersch, 2023; Ceken & Taskin, 2022; Mayer, 2024; Mayer & Moreno, 2003). The three media most often used in Indonesian vocational classrooms, however, are not interchangeable. Instructional video makes a temporal sequence visible and is most useful when learners are directed to essential information and prompted to act on it (Alemdag, 2022; Cooper & Higgins, 2015; Fiorella & Mayer, 2018; Fyfield et al., 2022; Polat, 2023; van der Linden et al., 2022). An electronic module carries the criteria, worked references, and self-check tasks that a student returns to while working (Dermawan & Fahmi, 2020; Sugihartini & Jayanta, 2017). A presentation medium is efficient for framing a problem and highlighting decision points before the workshop begins (Hutain & Michinov, 2022). Each medium therefore carries a different instructional load at a different moment in the project.

That distinction is largely invisible in the existing evidence. Development studies in Indonesian fashion education typically report a single feasibility score for a bundled product and a single outcome, so it is not possible to tell which component did what, which component is weakest, or where a school with limited resources should invest first (Ernawati et al., 2023; Pandansari & Gafur, 2016; Wati et al., 2024). Nor is creativity usually treated as a primary outcome, even though creative capability is precisely what distinguishes a fashion graduate who can work in the creative industries from one who can only follow a pattern (Harianto et al., 2024; Mahanani et al., 2023; Pongo et al., 2019; Vitariyanti et al., 2024). Validating each medium separately, and reporting creativity alongside feasibility and practicality, would give schools and curriculum developers something they can act on.

The present study addresses that gap. It reports the design and validation of a project-based multimedia package for the Design and Production subject, specifically the sewing of children's wear, in two Indonesian state vocational schools. The study asked four questions: (1) How feasible is each of the three media components when validated separately by subject and media experts? (2) With what fidelity are the six PjBL phases implemented when the package is used? (3) How practical is the package from the perspective of students and practising teachers? and (4) What creativity profile do students show after working through the project, and how does it sit alongside their cognitive, affective, and psychomotor attainment? Because the implementation used a one-group design without a comparison class, the study reports design quality, classroom viability, and change rather than causal effectiveness.

RESEARCH METHOD

Research design

The study used research and development with the ADDIE model, which organises work into analysis, design, development, implementation, and evaluation, with revision built into each stage (Branch, 2009). ADDIE was chosen because the research question concerns the quality of a designed artefact as much as its effect, and because the model allows formative correction before a product reaches a classroom. Within the implementation stage, learning outcomes were measured using a one-group pretest-posttest arrangement. No comparison class was used, so the outcome data are treated as evidence of change under realistic conditions rather than as an estimate of a causal effect.

Participants and setting

The population comprised the 37 vocational secondary schools in Pamekasan Regency, East Java. Purposive sampling selected the four state schools offering the Fashion Design skill programme with the Design and Production subject. SMKN 1 Pasean and SMKN 1 Pakong were used for the small-scale trial and instrument testing (60 students), and SMKN 3 Pamekasan and SMKN 1 Proppo were used for the large-scale field trial (120 Grade XI students in four classes of about 30). Data were collected in the even semester of the 2024/2025 academic year. Five experts, three practising fashion teachers, and three independent classroom observers also took part. The dataset did not record student gender, prior achievement, or school-level resource indicators, so no subgroup analysis was possible.

The multimedia package and its integration into the project

The analysis stage combined classroom observation at the two field-trial schools with interviews of six fashion teachers and a review of prior research. It identified a gap between a curriculum that asks for creativity and critical thinking and a classroom reality dominated by lecture, printed handouts, and repeated teacher demonstration. The design and development stages produced three coordinated media: a storyboarded video tutorial of the children's-wear sewing sequence, an interactive presentation with animation and embedded quiz items, and a digital module containing material, exercises, and self-evaluation. A usage guide for teachers and students accompanied the package. The three media were then mapped onto the six PjBL phases so that each phase had a designated primary medium rather than all three being available at once. Table 1 sets out that mapping together with the number of implementation indicators observed in each phase.

Table 1. Integration of the three media into the six PjBL phases and observed implementation

Phase	Classroom Activity	Primary Medium	Indicators Observed
Driving question	Pose an authentic children's-wear problem and motivate students	Interactive presentation	4 of 4 (2 teacher, 2 student)
Project planning	Plan the product, materials, roles, criteria, and workflow	E-module	4 of 4 (2 teacher, 2 student)
Scheduling	Build a four-week timeline from design to finishing	E-module	3 of 3 (2 teacher, 1 student)
Project	Observe progress and give	Video	4 of 4

Phase	Classroom Activity	Primary Medium	Indicators Observed
monitoring	technical guidance during sewing	tutorial	(2 teacher, 2 student)
Product testing	Present the finished garment and assess it against a rubric	Video tutorial	4 of 4 (2 teacher, 2 student)
Experience evaluation	Reflect on process, outcome, and improvement	E-module	2 of 2 (1 teacher, 1 student)
Total			23 of 23 (13 teacher, 10 student)

Note. Implementation was scored on a dichotomous yes/no form by three independent observers during the large-scale field trial.

Instruments

Five experts, comprising subject specialists and experienced fashion practitioners, rated each medium on a four-point Likert scale using a separate validation sheet: the video tutorial on content and display, the e-module on content, language, and presentation, and the interactive presentation on tidiness, image and colour quality, suitability to the material, and effectiveness. Each sheet was framed around the alignment between objectives, material, medium, and assessment (Buckley et al., 2021), and a mean rating of 3.25 to 4.00 was read as very feasible. Implementation was recorded on a 23-indicator observation form covering the six phases from the perspective of both teacher and student. Practicality was measured with a six-aspect student questionnaire and a five-aspect practitioner questionnaire. Creativity was assessed from the finished garment and an accompanying questionnaire against four indicators drawn from the divergent thinking literature, namely fluency, flexibility, originality, and elaboration (Lopez Martinez et al., 2024). Cognitive attainment was measured with a higher-order-thinking test, affective attainment with an attitude rubric, and psychomotor attainment with a product and process rubric aligned to the revised taxonomy of educational objectives (Krathwohl, 2002).

Data analysis

Expert, practitioner, and student ratings were analysed descriptively as mean ratings and percentages against the feasibility and practicality criteria. Observation data were summarised as the proportion of indicators recorded as present. Cognitive scores were checked for normality with Kolmogorov-Smirnov and Shapiro-Wilk tests and for homogeneity with Levene's test, then compared with a paired-samples t test. The magnitude of change was expressed as a normalised gain, with values of 0.70 and above read as high (Hake, 1998). Creativity scores were classified as low, moderate, or high and reported as a distribution. Reliability of the questionnaire scales was examined with coefficient alpha (Cronbach, 1951).

RESULTS AND DISCUSSION

Results

Component-level feasibility

All three media met the criterion for very feasible, but they did not do so equally. The e-module was rated highest at 3.96, driven by full marks on language and presentation and 99% on content. The video tutorial followed at 3.92, with display rated at the ceiling

and content at 99%. The interactive presentation was rated lowest at 3.80: effectiveness reached 100%, while tidiness, image and colour quality, and suitability to the material each sat at 95%. The spread is narrow but consistent in direction, and it locates the weakest link in the package in the visual craft of the presentation rather than in its instructional logic.

Table 2. Expert feasibility ratings of each media component (five validators)

Component	Aspects rated	Score	Mean Rating	Category
Video tutorial	Content (99%), display (100%)	55 of 56	3.92	Very feasible
E-module	Content (99%), language (100%), presentation (100%)	99 of 100	3.96	Very feasible
Interactive presentation	Tidiness (95%), image and colour (95%), suitability (95%), effectiveness (100%)	57 of 60	3.80	Very feasible

Note. Ratings were made on a four-point Likert scale; 3.25 to 4.00 was read as very feasible. Each component was validated on its own sheet, not as part of a bundled product.

Implementation fidelity

All 23 implementation indicators were recorded as present by all three observers in every phase, as shown in the final column of Table 1. The six phases were therefore visible in classroom practice rather than compressed into a conventional lesson with a final assignment, and the symmetry between the 13 teacher indicators and the 10 student indicators suggests that teacher facilitation and student participation moved together. The instrument was dichotomous, however, and a ceiling of this kind records occurrence rather than depth.

Practicality

Students rated every aspect of the package highly and did so consistently across the two trials. Aspect means ranged from 3.42 to 3.72 with 60 students and from 3.51 to 3.75 with 120 students, a difference of only 0.04 in the overall mean. Interest in the material was the strongest aspect in both trials and time adequacy the weakest, although even the weakest remained within the very practical band. Across the combined 180 students, 90.90% of aspect-level ratings fell in the very practical category and 178 students (98.89%) were classified as very practical overall. The three practitioners rated the package 55 of 60 for practicality (91.67%) and 95.00% for effectiveness, judging that it could be adopted without significant revision.

Table 3. Student and practitioner ratings of practicality

Aspect	Small-scale (n = 60)	Large-scale (n = 120)	Rated very practical
Ease of use	3.58	3.61	88.75%
Time adequacy	3.42	3.51	80.00%
Fit with school facilities	3.65	3.68	93.75%
Interest in the material	3.72	3.75	97.08%
Learning benefit	3.68	3.71	95.42%
Comfort of learning	3.55	3.59	90.42%
Overall student mean	3.60	3.64	90.90%
Practitioner rating (three teachers)		91.67% practicality; 95.00% effectiveness	Very practical

Note. Student ratings were made on a four-point scale. The final column reports the proportion of aspect-level ratings in the very practical category across all 180 students.

Student creativity

Creativity was the outcome on which the package performed most distinctively. Of the 120 students in the field trial, 85 (70.83%) reached the high category and 32 (26.67%) the moderate category, leaving only three students (2.50%) in the low category. Scores ranged from 85 to 100 with a mean of 90.00. Taking moderate as the minimum acceptable level, 117 students (97.50%) met or exceeded it. The garments themselves showed the pattern the rubric was built to detect: a wider range of design solutions, more varied trim and finishing choices, and more elaborated detail than the teachers reported seeing in previous cohorts.

Table 4. Distribution of student creativity scores (n = 120)

Creativity Category	Students	Percentage
High	85	70.83%
Moderate	32	26.67%
Low	3	2.50%
Total	120	100%

Note. Minimum 85, maximum 100, M = 90.00. Creativity was scored against fluency, flexibility, originality, and elaboration.

Learning outcomes

The three attainment domains moved in the same direction. Cognitive scores rose from a pretest mean of 64.75 to a posttest mean of 90.21, and the proportion of students meeting the mastery criterion rose from 15% to 90%. The paired-samples test was significant, $t(119) = -44.90$, $p < .001$, and the normalised gain of 0.81 sits in the high band. Affective attainment reached a mean of 3.65 with 95.8% of students meeting the criterion, and psychomotor attainment reached a mean of 90.12 with 91.7% mastery. Preliminary checks supported the use of a parametric test: the pretest and posttest distributions were normal ($p = .200$ and $p = .063$) and variances were homogeneous.

Table 5. Learning outcomes after the intervention (n = 120)

Domain	Result	Mastery	Category
Cognitive	M = 64.75 to M = 90.21; $t(119) = -44.90$, $p < .001$; N-gain = 0.81	15% to 90%	High gain
Affective	M = 3.65 (range 3.20 to 3.90)	95.8%	Very good
Psychomotor	M = 90.12 (range 70 to 100)	91.7%	Very good

Note. Mastery was set at a score of 75 for the cognitive and psychomotor domains and at 3.25 on a four-point scale for the affective domain

Discussion

The most useful finding of this study is not that the package was feasible, which was expected, but that the three media separated when they were rated separately. The e-module and the video tutorial sat almost at the ceiling, while the interactive presentation trailed on every aspect except effectiveness. Because the presentation is the medium that opens the project and frames the driving question, a weakness in its visual craft is felt at the point where student interest is established. This is the kind of information that a single bundled feasibility score conceals, and it has a practical consequence: a school with limited development capacity should refine the presentation before touching the other two components. The result supports the argument that

multimedia should be designed and evaluated by instructional function rather than as an undifferentiated resource (Ceken & Taskin, 2022; Mayer, 2024), and it is consistent with evidence that the visual and emotional quality of a presentation interface shapes the engagement it produces (Doherty, 2022; Peng et al., 2021).

The division of labour across the project cycle also worked as designed. The video tutorial carried the monitoring and testing phases, where a temporal sequence has to be made visible and revisited at the machine, which is consistent with evidence that video is most effective when learners are directed to essential information and can pause, attempt, and repeat (Cooper & Higgins, 2015; Fiorella & Mayer, 2018; Tani et al., 2022; Tseng, 2021; Zolkwer et al., 2023). The e-module carried planning, scheduling, and evaluation, where students need criteria they can return to rather than a sequence they must follow, matching the role that digital modules play in supporting self-directed study in vocational contexts (Dermawan & Fahmi, 2020; Qi et al., 2026; Sugihartini & Jayanta, 2017). Teacher presence remained necessary throughout; the media reduced repeated demonstration but did not replace supervision (Polat, 2023; van der Linden et al., 2022).

The creativity result deserves emphasis because it is the outcome least often reported in this literature. Seven in ten students reached the high category and fewer than one in forty remained low. Project work plausibly accounts for much of this: an authentic brief, genuine constraints of fabric and fit, collaboration, and a product that will be shown and critiqued are the conditions under which divergent thinking is exercised rather than merely discussed (Kristiana et al., 2025; Loyens et al., 2023; Suwarno et al., 2020). The multimedia contribution is more specific: by removing much of the procedural uncertainty from the sewing sequence, the video and the module free attention for design decisions that would otherwise be crowded out by the effort of remembering what to do next. This reading is consistent with cognitive-load accounts of multimedia design (Hoch et al., 2023; Mayer & Moreno, 2003). It should be qualified, however, since creativity was measured once, after the intervention, with no baseline and no comparison group, so the distribution describes a state rather than a gain.

Practicality was high and, more importantly, stable. The difference between the small-scale and large-scale means was 0.04, and the pattern of strongest and weakest aspects was identical in both, which suggests that the ratings reflect properties of the package rather than of a particular class. Time adequacy was consistently the weakest aspect in both trials. That is a design signal rather than a defect in the media: a four-week cycle that has to accommodate research, design, sewing, finishing, presentation, and reflection compresses exactly the practice and revision that vocational skill requires. Segmenting the video into shorter units, assigning selected procedures for viewing before class, and protecting workshop time would address it without weakening the project structure (Hutain & Michinov, 2022; Liu et al., 2021; Wong & Hughes, 2023).

The perfect implementation score should be read with more caution than the other results. A dichotomous yes/no instrument records whether an activity occurred, not how well, and three observers agreeing on 23 binary judgements is a weaker warrant than the number suggests. Fidelity measurement in future work should use graded descriptors, record frequency and quality, report inter-rater agreement, and where possible draw on video sampling of lessons. The same ceiling concern applies to the practicality classification, in which 98.89% of students fell into a single category.

Contribution to the sustainable development goals

Read against the sustainability agenda, the study contributes to SDG 4 in a specific rather than a general way. Target 4.4 is defined by the number of young people holding relevant technical and vocational skills, and the psychomotor and creativity results speak directly to that definition: 91.7% of students met the practical mastery criterion and 70.83% reached high creativity in a competence that the garment industry actually hires for. The contribution extends to SDG 8 on decent work and economic growth, since employability in the creative and garment sectors rests on demonstrable workmanship and on the capacity to generate and elaborate design solutions rather than on certification alone (Pongo et al., 2019; Vitariyanti et al., 2024). A third link, to SDG 12 on responsible consumption and production, is available but not yet realised. The planning and material-selection phases of the project are the natural place to teach fabric efficiency, offcut reduction, and durable construction, and the assessment rubric could carry sustainability criteria alongside technical ones. That was not done here and was not measured; it is the most concrete extension this line of work invites (Farid et al., 2021; Naseer et al., 2025).

Limitations

Four limitations constrain what can be claimed. First, the implementation used a single group with no comparison class, so maturation, testing, and teacher effects cannot be separated from the contribution of the package. Second, creativity, affective, and psychomotor outcomes were measured only after the intervention, so they describe attainment rather than change. Third, demographic and school-resource variables were not recorded, which prevents any analysis of whether the package worked equally well for different students or in differently equipped workshops. Fourth, the field trial was confined to four state schools in one regency, all offering the same subject, so generalisation beyond that setting is a matter for replication rather than inference.

CONCLUSION

Fundamental Finding: A three-component project-based multimedia package for children's-wear sewing was rated very feasible by experts when each medium was validated separately, was implemented with full observed fidelity across the six PjBL phases, was judged very practical by 180 students and three practitioners, and was accompanied by high creativity in 70.83% of students alongside substantial cognitive, affective, and psychomotor attainment. **Implication:** Validating media by component rather than as a bundle tells schools where to invest: here the interactive presentation, not the video or the module, was the weakest link, and it sits at the point where student interest in the project is established. Mapping each medium to a designated phase of the project, rather than making all media available at once, is a design principle that other vocational subjects can adopt. The work supports SDG 4 Target 4.4 and, through employability, SDG 8. **Limitation:** The implementation used one group without a comparison class; creativity and the affective and psychomotor domains were measured only after the intervention; demographic and resource variables were unavailable; and the fidelity and practicality instruments produced ceiling effects. **Future Research:** A cluster quasi-experimental or randomised design with a pretest measure of creativity, graded fidelity descriptors with reported inter-rater agreement, component-isolating comparisons such as module-only and video-only conditions, and the addition of sustainability criteria to the product rubric would strengthen both the causal claim and the SDG 12 contribution.

ACKNOWLEDGEMENTS

The authors thank Universitas Negeri Surabaya for its support, the promoters and examiners for their guidance, and the principals, teachers, and Grade XI students of SMKN 3 Pamekasan, SMKN 1 Proppo, SMKN 1 Pakong, and SMKN 1 Pasean for their participation.

AUTHOR CONTRIBUTIONS

Tri Mutmainnah: conceptualization, methodology, investigation, data curation, formal analysis, and writing of the original draft. **Marniati:** conceptualization, supervision, validation, and writing through review and editing. **Ratna Suhartini:** supervision, resources, project administration, and writing through review and editing. All listed authors have read and approved the final version of this submission and agree to be accountable for all aspects of the work.

CONFLICT OF INTEREST STATEMENT

The authors confirm that there are no conflicts of interest, either financial or personal, that may have influenced the content or outcome of this study.

ETHICAL COMPLIANCE STATEMENT

This manuscript complies with research and publication ethics. The authors affirm that the work is original and free from plagiarism, data fabrication, data falsification, and duplicate submission. The field trials involved human participants in school settings. Permission was obtained from the school authorities concerned, participation was voluntary, and informed consent was obtained from the participating students and, where required, from their parents or guardians. No identifying information was collected; all data were analysed anonymously and are reported only in aggregate form. This article reports the design and validation strand of a doctoral study; the findings presented here do not duplicate those reported elsewhere from the same project.

STATEMENT ON THE USE OF AI OR DIGITAL TOOLS IN WRITING

The authors used Mendeley for reference management, IBM SPSS Statistics for the statistical analyses, and Grammarly for language checking. No generative AI tool was used to collect data, conduct the analyses, or produce the scientific arguments of this article. The authors reviewed all digitally assisted output and take full responsibility for the manuscript.

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