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Project-Based Multimedia for Fashion Vocational Education: Learning, Creativity, and Practicality in Support of SDG 4

Tri Mutmainnah*, Marniati, Meini Sondang Sumbawati, Ratna Suhartini

State University of Surabaya, Surabaya, Indonesia



DOI : <https://doi.org/10.63230/jocsis.3.4.333>

Sections Info

Article history:

Submitted: March 4, 2026
Final Revised: August 8, 2026
Accepted: August 30, 2026
First Available Online: September 27, 2026
Publication Date: December 27, 2027

Keywords:

Creativity;
Fashion Vocational Education;
Learning Outcomes;
Multimedia Learning;
Project-Based Learning.

ABSTRACT

Objective: To evaluate multimedia-supported Project-Based Learning (PjBL) in fashion vocational education, by integrating conceptual knowledge, creativity, and procedural skills through a module, video tutorials, and presentation materials. **Method:** Sequential one-group field trials involved 60 and 120 vocational fashion students. The multimedia package was embedded in six PjBL phases, and experts validated the instruments and tested their reliability. **Results:** Cognitive scores increased from 25.25 to 33.03 in the small-scale trial, $t(59) = -9.59$, $p < .001$, $d_z = 1.24$, and from 24.48 to 34.98 in the large-scale trial, $t(119) = -27.56$, $p < .001$, $d_z = 2.52$. Creativity improved descriptively; affective mastery reached 73.33% and 79.17%, while psychomotor mastery was uneven at 55.00% and 39.17%. Students rated the multimedia highly practical (90.90%), practitioners rated it practical and effective, and all six PjBL phases were observed. **Novelty:** To evaluate cognitive, affective, psychomotor, creativity, practicality, and implementation-fidelity indicators together across sequential field trials. The findings support multimedia-supported PjBL as promising for cognitive learning and classroom usability, while the absence of a comparison group and uneven practical outcomes limit causal claims. The study contributes to SDG 4, particularly Target 4.4 on technical and vocational skills.

INTRODUCTION

Vocational fashion education sits at the intersection of conceptual learning, creative design, and skilled production. Students are expected to understand design principles, translate ideas into visual plans, select materials, operate tools, construct garments, and evaluate the quality of a finished product. This combination makes fashion learning particularly demanding: conceptual explanations alone are insufficient, but unguided practice can also leave learners without the cognitive structure needed to plan, troubleshoot, and reflect. The challenge is therefore not simply to add technology to instruction, but to organize technology, project activity, and feedback into a coherent learning sequence. These demands also raise sustainability concerns. Inclusive and equitable quality education is the substance of Sustainable Development Goal (SDG) 4, and Target 4.4 in particular calls for increasing the number of young people who hold relevant technical and vocational skills for employment and decent work (Cahyono et al., 2025).

Project-Based Learning (PjBL) offers a plausible structure for this purpose because it connects knowledge with an extended task that culminates in a product, performance, or public explanation. Foundational accounts of PjBL emphasize a driving problem, learner decision-making, sustained inquiry, collaboration, monitoring, and reflection (Blumenfeld et al., 1991). Reviews and meta-analytic evidence generally link PjBL to positive academic, motivational, and skill-related outcomes, although effects vary by implementation quality, discipline, duration, assessment, and comparison condition (Chen & Yang, 2019). These conditions are especially relevant in vocational settings,

where process quality matters as much as completing the product (Tavakol & Dennick, 2011; Wang & Somasundram, 2025; Wati et al., 2024).

Multimedia can strengthen PjBL by providing timely representations of processes that are difficult to communicate through verbal explanation alone (Abdulrahaman et al., 2020). In fashion production, modules can organize concepts and criteria; video tutorials can make sequential actions visible; and presentation materials can highlight key decisions, examples, and common errors. Multimedia learning theory suggests that coordinated verbal and visual representations may support understanding when they are designed to manage cognitive processing rather than merely increase visual richness (Mayer, 2021). Instructional video is most useful when it directs learners to essential information and prompts them to engage actively with what they observe (Fiorella & Mayer, 2018). In vocational education, this implies that video should complement, not replace, supervised hands-on practice.

Recent vocational studies have reinforced the value of contextual, project-oriented, and digitally supported learning. PjBL has been associated with stronger engagement, critical thinking, and skill development in secondary and higher vocational contexts (Huang et al., 2026). In Indonesian fashion education, project modules, video tutorials, and PjBL implementations have been judged feasible and have shown promising learning outcomes (Pawar et al., 2026; Prasetyaningtyas et al., 2026; Wati et al., 2024). Nevertheless, much of this evidence focuses on product feasibility or a single outcome. Fewer studies examine cognitive, affective, psychomotor, creativity, practicality, and implementation-fidelity indicators together across sequential field trials (Patonah, et al., 2025).

The present study addresses that gap by evaluating multimedia-supported PjBL for students in a vocational fashion program. The multimedia package consisted of a learning module, video tutorials, and presentation slides integrated into a six-phase PjBL sequence (Borja-Tomás et al., 2023; Gómez-Trigueros, 2024). The study asked four questions: (1) Were the multimedia and measurement instruments sufficiently valid and reliable? (2) Did cognitive scores improve from pretest to posttest in small- and large-scale field trials? (3) What patterns appeared in affective, psychomotor, and creativity outcomes? (4) How practical and implementable was the approach from student, practitioner, and observer perspectives? Because both field trials used one-group pretest-posttest designs, the study evaluates change and implementation promise rather than definitive causal effectiveness. The study is therefore positioned within the SDG agenda: it evaluates an instructional design intended to build the technical and creative competence described in SDG 4.4, which in turn underpins SDG 8 on decent work and economic growth and, through the material, production, and waste decisions that fashion graduates make in practice, SDG 12 on responsible consumption and production.

RESEARCH METHOD

Research design and participants

The study used a development-and-evaluation design with sequential field trials. After expert review and instrument testing, the multimedia-supported PjBL package was implemented in a small-scale trial with 60 vocational fashion students and a large-scale trial with 120 students. The two stages produced a total user sample of 180 students. Both trials used a one-group pretest-posttest structure for cognitive achievement. The available dataset did not include participant gender, grade-level distribution, or school-level demographic variables; consequently, subgroup analyses were not conducted (Alonso-Pastor et al., 2025).

Intervention

The intervention combined three multimedia components: a learning module, video tutorials, and PowerPoint presentation materials. These resources supported a fashion-making project that moved from identifying problems and planning designs to scheduling, production, presentation, and reflection. Observation instruments organized implementation into six PjBL phases. The project timeline covered four instructional weeks and included research, design, sewing, finishing, product presentation, and evaluation.

Table 1. Six phases of the multimedia-supported fashion project

Phase	Instructional Activity	Primary Learning Function
Driving question	Introduce an authentic fashion-making problem and motivate students	Problem framing and critical thinking
Project planning	Plan the product, materials, roles, criteria, and workflow	Collaboration and decision-making
Scheduling	Create a four-week timeline from research and design to sewing and finishing	Time and project management
Project monitoring	Observe progress and provide technical guidance during production	Feedback and procedural support
Product testing	Present the fashion product and assess it with a rubric	Performance and communication
Experience evaluation	Reflect on the process, outcomes, and needed improvements	Metacognition and revision

Note. The phases were derived from the implementation observation instrument in the source dataset.

Instruments

Five experts evaluated content validity: three doctoral-level vocational education academics and two experienced fashion teachers or practitioners. The experts reviewed alignment with learning indicators, clarity, and content accuracy. We calculated Aiken's V coefficients for the module, video tutorials, presentation slides, cognitive test, affective rubric, psychomotor rubric, and creativity rubric. Values ranged from 0.86 to 0.92.

The initial cognitive test contained 60 multiple-choice items. We conducted empirical item analysis with 60 students using item-total correlations and a critical correlation value of 0.254. We retained 50 items and removed 10. The 50-item version obtained a Cronbach's alpha of 0.893 (Cronbach, 1951), compared with 0.847 for the original 60-item set. Additional measures included a four-item affective assessment, a five-aspect psychomotor assessment, a five-aspect creativity assessment, a six-aspect student-practicality questionnaire, practitioner ratings of practicality and effectiveness, and a 23-indicator PjBL implementation observation form (13 teacher indicators and 10 student indicators) completed by three observers.

Table 2. Instrument validation and reliability summary

Instrument	Aiken's V	Decision
Learning module	0.92	Very valid
Video tutorials	0.90	Very valid
Presentation slides	0.88	Valid
Cognitive test	0.89	Very valid
Affective rubric	0.87	Valid
Psychomotor rubric	0.91	Very valid

Creativity rubric	0.86	Valid
Cognitive test reliability (50 retained items)	$\alpha = 0.893$	Highly reliable

Procedure and data analysis

Students completed the cognitive pretest before the multimedia-supported project and the posttest after the learning sequence. We assessed affective, psychomotor, and creativity performance during or at the end of the project. Students then evaluated ease of use, time efficiency, compatibility with school resources, content engagement, learning benefits, and learning comfort. Three practitioners rated the intervention's practicality and effectiveness, while three observers recorded whether each teacher and student implementation indicator occurred.

Analyses included Aiken's V, item-total correlations, Cronbach's alpha (Cronbach, 1951), descriptive statistics, Shapiro-Wilk normality tests, and paired-samples t tests. Reported p values of 0.000 were expressed as $p < 0.001$ (Shapiro & Wilk, 1965). To improve interpretation beyond statistical significance, we derived standardized within-group effect sizes as Cohen's d_z (Cohen, 2013; Lakens, 2013) by dividing the mean change by the standard deviation of the change scores. We derived confidence intervals for mean change from the reported standard errors and degrees of freedom. The original analysis also reported Levene statistics; these are not emphasized here because homogeneity between pretest and posttest scores is not a primary assumption of a paired-samples t test (Field, 2024).

RESULTS AND DISCUSSION

Results

Instrument quality

All seven instruments met the study's content-validity criterion. Aiken's V ranged from 0.86 for the creativity rubric to 0.92 for the learning module. The psychomotor rubric (0.91), video tutorials (0.90), and cognitive test (0.89) also received high expert ratings. Of the 60 cognitive items, the researchers retained 50 (83.33%). Reliability improved after item removal, with alpha increasing from 0.847 to 0.893. These results support the cognitive test's internal consistency and the content relevance of the multimedia and performance measures.

Cognitive outcomes

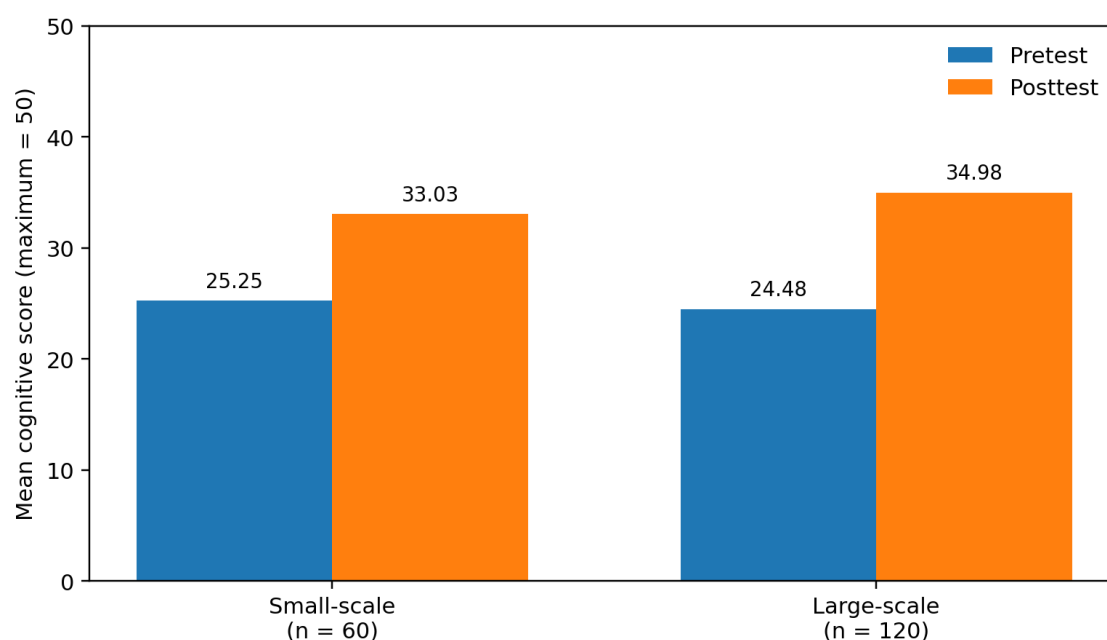
In the small-scale trial, the cognitive mean increased from 25.25 (SD = 3.29) to 33.03 (SD = 3.19), a mean gain of 7.78 points. The paired-samples test was statistically significant, $t(59) = -9.59$, $p < 0.001$. Expressed in the direction of improvement, the 95% confidence interval for the mean gain was [6.16, 9.41], and the standardized within-group effect was large, $d_z = 1.24$. In the large-scale trial, the mean increased from 24.48 (SD = 3.10) to 34.98 (SD = 2.98), a gain of 10.50 points. The difference was statistically significant, $t(119) = -27.56$, $p < 0.001$, with a 95% confidence interval of [9.75, 11.25] and a very large standardized within-group effect ($d_z = 2.52$). The larger estimate in the second trial should not be interpreted as proof that scale itself caused a stronger effect; it may reflect cohort, implementation, or sampling differences.

Table 3. Cognitive pretest–posttest results across field trials

Trial	Pretest M (SD)	Posttest M (SD)	Mean gain [95% CI]	t(df), p	d_z
Small-scale	25.25 (3.29)	33.03 (3.19)	7.78	-9.59 (59),	1.24

(n = 60)			[6.16, 9.41]	< .001	
Large-scale	24.48 (3.10)	34.98 (2.98)	10.50	-27.56 (119),	2.52
(n = 120)			[9.75, 11.25]	< .001	

Note. Positive mean gains are reported as posttest minus pretest. d_z values were derived from the reported mean and standard deviation of paired change scores.



Note. The cognitive test contained 50 retained items.

Figure 1. Mean cognitive scores before and after the intervention

Affective, psychomotor, and creativity outcomes

Affective performance was categorized as good in both trials. The mean was 2.61 in the small-scale trial and 2.65 in the large-scale trial, with mastery rates of 73.33% and 79.17%, respectively. Creativity showed a modest descriptive improvement: the mean increased from 72.63 to 75.28, and the proportion of students in the high category increased from 25.00% to 30.83%. Most students remained in the moderate creativity category (68.33% and 66.67%). No inferential test was reported for the creativity difference, so describe the pattern descriptively rather than as statistically significant.

Psychomotor results were less consistent than cognitive outcomes. The small-scale mean was 75.15, with 55.00% of students meeting the mastery criterion of 75. In the large-scale trial, the mean was 72.19 and only 39.17% met the criterion. Thus, although the intervention supported knowledge acquisition and was rated highly usable, practical performance did not improve uniformly across the field trials.

Practicality, practitioner evaluation, and implementation fidelity

Students rated all six practicality dimensions highly. Mean ratings ranged from 3.42 to 3.72 in the small-scale trial and from 3.51 to 3.75 in the large-scale trial on a four-point scale. Content engagement received the highest rating in both trials, whereas time suitability was the lowest. Across the two cohorts, 90.90% of aspect-level ratings fell in the very practical category, and 178 of 180 students (98.89%) were classified overall as rating the intervention very practical.

Practitioners rated the multimedia 91.67% practical and 95.00% effective. Observation data indicated that all three observers recorded all 23 implementation indicators as present: 13 teacher indicators and 10 student indicators across the six PjBL phases. The

result demonstrates very high reported fidelity, although the dichotomous response format created a ceiling and did not differentiate quality within completed indicators.

Table 4. Noncognitive, practicality, and fidelity outcomes

Outcome	Small-scale	Large-scale / combined	Interpretation
Affective	M = 2.61; 73.33% mastery	M = 2.65; 79.17% mastery	Good
Psychomotor	M = 75.15; 55.00% mastery	M = 72.19; 39.17% mastery	Uneven practical mastery
Creativity	M = 72.63; 25.00% high	M = 75.28; 30.83% high	Moderate; descriptive improvement
Student practicality	M = 3.60/4	M = 3.64/4; 90.90% aspect ratings very practical	High and consistent
Practitioner evaluation	91.67% practicality	95.00% effectiveness	Very positive
PjBL fidelity	13 teacher indicators	10 student indicators; 23/23 observed	100% reported implementation

Discussion

The principal finding is that cognitive achievement increased substantially in both field trials. Replicating pretest-posttest gains in samples of 60 and 120 students suggests the multimedia-supported PjBL package was workable across multiple implementation stages. The derived effect sizes were large, indicating that the mean change was substantial relative to the variability of individual change scores. This pattern is consistent with broader evidence that well-structured projects can improve academic achievement by connecting concepts to sustained, meaningful activity (Chen & Yang, 2019). It also aligns with recent vocational studies in which PjBL and digitally supported project modules strengthened engagement, critical thinking, and learning outcomes (Anwar et al., 2026).

The multimedia design likely contributed by making conceptual and procedural information accessible at multiple points in the project. The module could organize content and criteria, the video tutorials could externalize technical sequences, and the presentation materials could focus attention on key decisions. This combination aligns with multimedia learning theory, where each representation serves a clear instructional function (Mayer, 2021). The high rating for content engagement suggests that students found the materials relevant and appealing. However, engagement alone does not explain learning, and the study did not isolate each component's contribution. Future research should compare the complete package with module-only, video-only, or conventional PjBL conditions (Bell, 2010; Guo et al., 2020; Luo et al., 2023; Pawar et al., 2026).

The contrast between cognitive and psychomotor outcomes is important both theoretically and practically. Cognitive gains were strong, but practical mastery reached only 55.00% in the small-scale trial and 39.17% in the large-scale trial. Fashion construction requires perceptual-motor coordination, precision, repeated practice, feedback, and access to appropriate tools and materials. Multimedia can show what to do, but seeing a procedure does not ensure fluent execution. The finding supports the argument that instructional videos should be embedded in supervised, hands-on cycles with opportunities to pause, attempt, receive feedback, revise, and repeat (Botella Nicolás & Ramos, 2020; Fiorella & Mayer, 2018; Qi et al., 2026; Valdés & Martínez-

Líbano, 2025). It also echoes reports that fashion PjBL is sensitive to facilities, time allocation, and authentic assessment (Prasetyaningtyas et al., 2026).

The creativity pattern was positive but moderate. The mean increased descriptively, the high category became more common, yet approximately two-thirds of students remained in the moderate category. PjBL can create conditions for creativity through autonomy, authentic constraints, collaboration, and product development, but creativity is unlikely to emerge automatically from project participation. Learners may need explicit ideation strategies, exposure to diverse references, structured critique, opportunities to generate alternatives, and assessment criteria that reward originality alongside technical feasibility. A longer design cycle with iterative prototyping could produce stronger creative development than a single four-week project.

Affective mastery and practicality ratings were favorable. Students reported that the materials were useful, comfortable, and compatible with available resources, while content engagement was the strongest dimension. Time suitability was consistently the lowest-rated aspect, even though it remained positive. This is a meaningful implementation signal: the learning design was acceptable, but the schedule may have compressed the practice and revision needed for psychomotor mastery. Increasing workshop time, using shorter segmented videos, and assigning pre-class viewing for selected procedures may preserve engagement while creating more in-class time for supervised production (Kokotsaki et al., 2016).

The reported 100% fidelity across all phases indicates that the intended PjBL sequence was visible in classroom practice. High fidelity strengthens the interpretation that the intervention was implemented as designed rather than reduced to a conventional lesson with a final assignment. Nevertheless, interpret the perfect score cautiously. A dichotomous yes/no instrument is vulnerable to ceiling effects and may capture occurrence without capturing depth, responsiveness, or instructional quality. Future fidelity measures should use graded descriptors, record frequency and quality, include observer calibration, and report inter-rater agreement. Video-based sampling could further strengthen fidelity evidence (Marzalius et al., 2026).

Contribution to the sustainable development goals

Read against the sustainability agenda, the results are encouraging but partial. The strong, replicated cognitive gains indicate that the multimedia-supported package improved the quality and relevance of learning, which is the central concern of SDG 4 and, more precisely, Target 4.4 on technical and vocational skills for employment. Uneven psychomotor mastery qualifies that contribution, because Target 4.4 is defined by demonstrable skills rather than knowledge alone; a package that raises understanding without securing practical competence therefore delivers only part of the intended outcome. The same qualification applies to SDG 8 on decent work and economic growth, since employability in the garment sector rests on verified workmanship rather than on conceptual knowledge. The project structure also offers a concrete entry point for SDG 12 on responsible consumption and production, because the planning, material selection, and evaluation phases can teach fabric efficiency, waste reduction, and durable construction. The present study did not measure these sustainability links. Future work should assess them explicitly, for example by adding sustainability criteria to the product rubric and tracking material waste across the project cycle.

Methodological considerations

Several limitations constrain interpretation. First, neither field trial included a control or comparison group. Pretest-posttest improvement may reflect maturation, testing effects, teacher effects, or concurrent learning; therefore, the results should not be described as definitive causal proof. Second, demographic and school-level variables were unavailable, preventing analysis of whether the intervention worked similarly across gender, prior achievement, school resources, or teacher experience. Third, the normality analysis reported separate pretest and posttest distributions rather than the distribution of change scores, which is the more direct assumption for the paired t test. Fourth, the authors did not report inferential analyses for affective, psychomotor, creativity, or practicality outcomes.

These limitations also identify a clear research agenda. A stronger study would use a cluster quasi-experimental or randomized design, document participant and school characteristics, preregister primary outcomes, assess the normality of change scores, report confidence intervals and effect sizes for all outcomes, and collect follow-up data. Score practical performance with analytic rubrics and use blinded assessors where feasible. Processing data such as video access, revision frequency, teacher feedback, and time on task could clarify why knowledge gains were stronger than psychomotor mastery.

CONCLUSION

Fundamental Finding: The multimedia-supported PjBL package was valid, reliable, highly practical, and associated with substantial cognitive improvement, although psychomotor mastery remained uneven. **Implication:** Multimedia modules, video tutorials, and presentation materials can support vocational fashion learning when combined with sufficient hands-on practice and continuous technical feedback, thereby supporting SDG 4 (Target 4.4) and, indirectly, SDG 8 and SDG 12. **Limitation:** The study used a one-group pretest-posttest design without a comparison group, had limited participant demographic data, and did not conduct inferential analyses for all learning outcomes. **Future Research:** Future studies should use stronger comparative designs, more rigorous practical-skill assessments, and follow-up measurements to examine the effectiveness and sustainability of multimedia-supported PjBL.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to State University of Surabaya for its support, to the supervisors for their valuable guidance and constructive feedback throughout this research, and to all respondents who generously participated and contributed to the successful completion of this study.

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. **Meini Sondang Sumbawati:** methodology, instrument validation, formal analysis, 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, conducted with academic integrity, and free from any unethical practices, including plagiarism, data fabrication, data falsification, and duplicate submission. The field trials involved human participants in school settings. We obtained permission from the relevant school authorities; participation was voluntary, and we obtained informed consent from participating students and, where required, from their parents or guardians. We collected no identifying information; we analyzed all data anonymously and reported results only in aggregate.

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. The authors did not use any generative AI tool to collect data, conduct analyses, or develop the scientific arguments in this article. The authors reviewed all digitally assisted output and take full responsibility for the manuscript.

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*** Tri Mutmainnah, M.Pd. (Corresponding Author)**

Bachelor's Program in Fashion Education, Faculty of Engineering,
State University of Surabaya
Jl. Ketintang Wiyata, Ketintang, District. Gayungan, Surabaya, East Java 60231
Email: trimutmainnah@unesa.ac.id

Prof. Dr. Marniati, S.E., M.M.

Bachelor's Program in Fashion Education, Faculty of Engineering,
State University of Surabaya
Jl. Ketintang Wiyata, Ketintang, District. Gayungan, Surabaya, East Java 60231
Email: marniati@unesa.ac.id

Dr. Meini Sondang Sumbawati, M.Pd.

Master's Program in Electrical Engineering Education, Faculty of Engineering,
State University of Surabaya
Jl. Ketintang Wiyata, Ketintang, District. Gayungan, Surabaya, East Java 60231
Email: meinisonidang@unesa.ac.id

Prof. Dr. Ratna Suhartini, M.Si.

Doctoral Program in Vocational Education, Graduate School,
State University of Surabaya
Jl. Ketintang Wiyata, Ketintang, District. Gayungan, Surabaya, East Java 60231
Email: ratnasuhartini@unesa.ac.id
