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From Vanity to Canvas: Developing Educational Videos on Recycling Powder-Based Cosmetic Waste into Gouache Paint

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Abstract

Cosmetic waste has become an environmental concern, yet limited instructional media address its recycling through procedural learning in vocational cosmetology education. This study developed and validated CTML-based video learning materials integrating environmental knowledge with practical cosmetic waste recycling procedures. A Research and Development approach using the Four-D model (Define, Design, Develop, and Disseminate) was employed. The instructional video was designed based on the Cognitive Theory of Multimedia Learning (CTML), integrating visual demonstrations and verbal explanations. Data were collected through expert validation involving six experts and practicality testing involving 30 undergraduate cosmetology students. The results showed high validity, with material validity reaching 92.92% and media validity 93.64%. Student responses indicated high practicality at 88.27%. These findings indicate that the developed video provides validated and practical instructional media for cosmetic waste recycling in vocational cosmetology education. The study contributes to the application of CTML-informed multimedia design within sustainability-oriented vocational education and proposes an instructional design framework that may inform multimedia learning resources in other vocational contexts. Further studies should examine learning effectiveness and eco-consciousness through experimental designs.

Keywords: Cosmetic waste recycling; instructional video; Four-D Model.

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INTRODUCTION

Environmental sustainability has become one of the most urgent global concerns due to the continuous increase in waste generation resulting from industrial development and changing consumption patterns (Chandoliya et al., 2024). Among various forms of solid waste, cosmetic waste has recently emerged as an important environmental issue because of the rapid growth of the global beauty industry and the widespread use of cosmetic products in daily life. Cosmetic waste includes expired cosmetic products, residual formulations, and cosmetic packaging, many of which contain non-biodegradable materials such as synthetic pigments, metallic oxides, preservatives, polymers, and engineered nanoparticles. When disposed of through conventional household waste systems, these substances may persist in terrestrial and aquatic environments, potentially contributing to environmental pollution and ecological degradation. Previous studies have reported that zinc oxide and silver nanoparticles commonly used in cosmetic formulations may induce oxidative stress, cellular toxicity, and developmental abnormalities in aquatic organisms, indicating that cosmetic waste should be considered not only as a solid waste issue but also as an emerging environmental contaminant requiring sustainable management strategies (Hazeem, 2022; Lee et al., 2022). Furthermore, studies investigating consumer practices revealed that expired cosmetic products are frequently stored or used beyond their recommended shelf life, increasing both microbiological contamination risks and the accumulation of cosmetic waste requiring environmentally responsible disposal (Giacomel et al., 2013).

Previous studies on cosmetic waste have primarily examined environmental awareness, responsible consumption, eco-friendly product selection, and waste-management practices (Bashir & Lambert, 2020; Nadila Amanda et al., 2024; Sari et al., 2022; Septianingrum et al., 2023). These studies highlight the importance of developing environmentally responsible attitudes toward cosmetic products and their disposal. However, research addressing cosmetic waste from an educational and procedural perspective remains comparatively limited. In particular, existing studies provide limited evidence on how learners can be guided to transform cosmetic waste into value-added products through structured instructional activities. This gap is particularly relevant to vocational cosmetology education, where students engage directly with cosmetic materials during practical training and may subsequently encounter similar waste-management issues in professional practice (Karim et al., 2026). As future beauty practitioners, cosmetology students are expected not only to master technical competencies but also to demonstrate environmental responsibility through sustainable professional practices. Therefore, integrating cosmetic waste recycling into vocational learning represents an important strategy for connecting occupational

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competence with sustainability education. Such integration is consistent with the growing emphasis on Education for Sustainable Development, which encourages educational institutions to equip learners with the knowledge, practical skills, and environmental values necessary to address contemporary sustainability challenges. However, classroom observations reported in this study indicate that learning resources specifically designed to teach procedural cosmetic waste recycling remain limited, and existing instructional activities continue to focus predominantly on cosmetic application techniques rather than environmentally responsible post-consumption management.

In vocational education, instructional media that present step-by-step demonstrations are particularly important because practical competencies require learners to observe and reproduce procedures. Previous studies have shown that instructional videos can support procedural learning by providing demonstrations, visual guidance, and opportunities for repeated observation (Ibrahim Mohamed, 2012; Preradović et al., 2020). Video-based learning has also been applied in vocational practical courses to help students observe and reproduce work procedures (Puspitasari & Pratama, 2023). Similarly, Pamungkas and Camelia (2025) developed a video tutorial for producing a miniature bonsai from recycled materials, demonstrating the potential of video-based instruction to present recycling procedures in a structured and accessible manner. In environmental education, instructional videos have also been used to support students' knowledge and creativity in recycling activities (Syamsul Arifin & Nyoman Lodra, 2021). Recycling was positioned as a practical pathway through which cosmetic waste could be examined and selected expired powder-based cosmetic material could be transformed into a non-cosmetic artistic material, namely gouache paint. The developed video integrates an explanation of cosmetic waste characteristics and the 3R principles with a sequential demonstration of the recycling process and its application on canvas. This approach is consistent with previous work indicating that video can be used to communicate practical learning processes and recycling-related activities (Friendha Yuanta, 2019). Consequently, instructional media capable of presenting step-by-step demonstrations play an essential role in facilitating skill acquisition. Among various digital learning resources, instructional videos have been widely recognized as an effective medium for presenting procedural knowledge because they integrate visual demonstrations with verbal explanations in a structured and sequential manner. Students are able to repeatedly observe each learning step, pause or replay specific procedures, and learn independently according to their individual pace (Preradović et al., 2020; Puspitasari & Pratama, 2023). These characteristics make instructional videos particularly suitable for cosmetology

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education, where students must master practical techniques before applying them in laboratory or workshop activities. However, most existing instructional videos in cosmetology education primarily focus on beauty treatment procedures and technical application skills, while relatively limited attention has been given to sustainability-oriented practices such as cosmetic waste recycling. This indicates the need to develop instructional media that simultaneously supports procedural learning and environmental responsibility within vocational education.

The design of instructional videos should be grounded in appropriate learning theories to ensure that multimedia elements facilitate meaningful learning rather than merely attracting learners' attention. One of the most influential frameworks for multimedia instructional design is the Cognitive Theory of Multimedia Learning (CTML) proposed by Mayer, The Cognitive Theory of Multimedia Learning (CTML) provides a theoretical basis for multimedia instruction by explaining how verbal and visual information can be coordinated while unnecessary cognitive processing is minimised (Mayer, 2024). Previous applications of CTML have demonstrated its relevance to the design and evaluation of digital learning materials and instructional videos (AlShaikh et al., 2024; Cavanagh & Kiersch, 2023; Gde et al., 2021). In this study, CTML was operationalised through coherent presentation, signalling, segmenting, synchronised narration, and focused procedural demonstrations (Mayer, 2024).

Accordingly, the present study was designed around a conceptual connection among four elements: the environmental problem of cosmetic waste, sustainability-oriented vocational learning, CTML-informed multimedia design, and procedural recycling instruction. The video was not treated as an intervention whose effectiveness was to be established; instead, the study focused on the development and quality appraisal of an instructional resource. This distinction is important because the research design involved expert judgments of validity and students' perceptions of practicality, but did not include a control group, pretest-posttest measurement of learning outcomes, or a direct measure of changes in eco-consciousness. The study pursued two objectives: (1) to develop a CTML-based instructional video for cosmetic waste recycling in vocational cosmetology education using the Four-D model; and (2) to determine the validity and perceived practicality of the developed media. The theoretical contribution is the illustration of how CTML principles can be translated into sustainability-oriented procedural learning design. The practical contribution is the provision of a validated supplementary resource that can support classroom, blended, or independent learning activities.

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METHOD

A Research and Development approach was employed using the Four-D development model proposed by (Thiagarajan S et al., 1974). The model comprises four stages: Define, Design, Develop, and Disseminate. It was selected because the model provides a structured sequence through which instructional needs can be identified, a prototype can be designed, expert judgements can be obtained, revisions can be undertaken, and a limited user appraisal can be conducted. The Define stage comprised front-end analysis and learner analysis. A preliminary observation and survey were conducted with 30 students from the 2022 cohort of the Cosmetology and Beauty Study Program at Universitas Negeri Padang. The analysis identified a need for practical instructional material addressing cosmetic waste, the 3R principles, and recycling procedures. The findings also indicated a preference for visual and practice-oriented learning resources for this type of content. During the Design stage, the instructional format was selected, the learning content was organised, and the script and storyboard were developed. The video was structured around four core components: (1) the characteristics and environmental considerations of powder-based cosmetic waste; (2) the Reduce, Reuse, and Recycle principles; (3) the step-by-step transformation of expired powder cosmetics into gouache paint; and (4) the application of the recycled material on canvas. CTML-informed design considerations were incorporated through coherent visual presentation, signalling of relevant information, segmentation of procedures, synchronised narration, and alignment between verbal explanations and visual demonstrations.

During the Develop stage, the prototype was produced, reviewed by experts, revised, and subjected to a limited practicality assessment. Six experts were involved: three subject-matter experts and three media experts. The subject-matter experts assessed content quality, language, pedagogical value, and the clarity of the recycling tutorial. The media experts assessed visual communication, typography and text, audio and narration, presentation and flow, and technical media quality. The prototype was revised on the basis of the experts' recommendations before the practicality assessment was conducted.

Instrument quality was examined separately from product quality. Aiken's V was used to assess the content validity of the expert validation instruments and the student practicality questionnaire. The expert validation instruments yielded Aiken's V coefficients of 0.91 for the content aspect and 0.92 for the media aspect. The student practicality questionnaire yielded coefficients of 0.83 for the content aspect and 0.84 for the media aspect. The internal consistency of the practicality questionnaire was examined using Cronbach's alpha and yielded a coefficient

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of 0.88.

Product validity was analysed using descriptive percentage scores derived from expert ratings. Material validity was calculated from the combined ratings provided by the three subject-matter experts, whereas media validity was calculated from the combined ratings provided by the three media experts. Practicality was assessed using a questionnaire completed by 30 cosmetology students after they had viewed the video. The practicality assessment covered guidance and reference, video material, duration and portion, ease of use, and perceived usefulness and motivation. The analysis was descriptive and was not intended to test causal effects or learning gains.

The Disseminate stage involved limited distribution of the developed video as a supplementary learning resource. The final video was prepared in a 16:9 horizontal format and made accessible through YouTube, in accordance with the development procedure reported in the thesis. Because dissemination was limited, the findings should be interpreted as evidence from a development and feasibility process rather than as evidence of effectiveness or generalisability.

RESULT AND DISCUSSION

Result

The development process resulted in a CTML-informed instructional video on cosmetic waste recycling. The final learning resource combines explanatory content with procedural demonstrations so that the environmental rationale and the practical sequence are presented within a coherent instructional flow. The video contains an introduction, an explanation of cosmetic waste and its environmental implications, the 3R principles, preparation of tools and materials, the recycling procedure for powder-based cosmetic waste into gouache paint, application of the recycled material on canvas, and a closing section.

Table 1. Summary of the Four-D development process

1. Define
Front-end analysis, learner analysis, identification of knowledge and procedural gaps, and identification of instructional needs and content requirements.
2. Design
Media selection, content organization, script development, storyboard preparation, and CTML-informed instructional sequencing.
3. Develop

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Video production, expert validation, revision based on expert feedback, and limited practicality assessment.
4. Disseminate Limited distribution of the validated instructional video through a digital platform as a supplementary learning resource.

EXPERT VALIDATION

Material validation yielded an overall score of 92.92%. The highest mean score was obtained for content quality (94.28%), followed by pedagogical value (93.05%) and clarity of the recycling tutorial (91.66%). Language received a mean score of 86.66%. Overall, the material was categorised as highly valid according to the criteria applied in the development study.

Table 2. Quantitative Results of the Material Validation Assesment

Evaluative Dimension	Validator I	Validator II	Validator III	Mean Score
Content Quality	94.28%	91.43%	97.14%	94.28%
Linguistic	80.00%	100.00%	80.00%	86.66%
Pedagogical Value	92.50%	93.33%	93.33%	93.05%
Clarity of Recycling Tutorial	92.00%	88.00%	95.00%	91.66%
Cumulative Material Validity Percentage	**92.50%**	**91.25%**	**95.00%**	**92.92%**
Category	**Highly Valid**	**Highly Valid**	**Highly Valid**	**Highly Valid**

Media validation yielded an overall score of 93.64%. Visual communication obtained a mean score of 94.16%, audiovisual and narration quality 92.50%, and cognitive load optimisation 94.33%. Overall, the media was categorised as highly valid. The high score for cognitive load optimisation is particularly relevant to the CTML-informed design because the evaluation considered the organisation of visual and verbal information and the minimisation of unnecessary elements.

Evaluative Dimension	Validator I	Validator II	Validator III	Mean Score
Visual Communication	95.00%	92.50%	95.00%	94.16%

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Audiovisual & Narration Quality	90.00%	95.00%	92.50%	92.50%
Cognitive Load Optimization	96.00%	94.00%	93.00%	94.33%
Cumulative Media Validity Percentage	**91,82%**	**94,55%**	**94,55%**	**93.64%**
Category	**Highly Valid**	**Highly Valid**	**Highly Valid**	**Highly Valid**

Table 3. Quantitative Results of the Media Design and Technical Validation Assessment

PRACTICALITY ASSESMENT

The limited practicality assessment involved 30 students from the Cosmetology and Beauty Study Program. An overall practicality score of 88.27% was obtained and was categorised as highly practical. At the indicator level, the revised manuscript reported the highest responses for relevance and learner motivation (90.25%) and perceived comprehension of the tutorial and related concepts (89.50%). The questionnaire reported in the thesis also indicated strong responses across the dimensions of guidance, material, duration, ease of use, and usefulness and motivation.

Table 4. Student practicality results

Practicality Aspect	Score (%)	Interpretation
Reference and guidance	88.00	Highly practical
Video material	88.00	Highly practical
Duration and portion	88.00	Highly practical
Ease of media use	87.33	Highly practical
Usefulness and motivation	90.00	Highly practical
Overall practicality	88.27	Highly practical

DISCUSSION

The development results indicate that the instructional video received consistent expert appraisal across the content and media dimensions. The material validity score of 92.92% indicates that the explanations of cosmetic waste, the 3R principles, and the recycling procedure were judged appropriate for the intended instructional context. Similarly, the media validity score of 93.64% indicates that the visual, audiovisual, presentation, and technical components were judged appropriate. Taken together, these findings indicate that the developed resource met the

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content and media quality criteria applied in the development study.

The findings should, however, be interpreted in relation to the purpose and scope of the evaluation. High expert scores do not establish that the video improves learning outcomes. Rather, they indicate that the experts judged the content and media characteristics favourably against the specified assessment criteria. Likewise, the student score of 88.27% represents perceived practicality and usability. It should not be interpreted as evidence that students' knowledge, recycling skills, or eco-consciousness increased after the video was used. Maintaining this distinction is important for ensuring that the conclusions remain consistent with the research design and do not extend beyond the evidence obtained.

The highest-rated media dimension was cognitive load optimisation, with a score of 94.33%. This finding is theoretically relevant because the video was intentionally designed in accordance with CTML principles. The instructional sequence incorporates focused visual demonstrations, synchronised narration, and segmented procedural steps. These design choices are consistent with the CTML premise that meaningful multimedia learning involves the active processing of relevant verbal and visual information while unnecessary processing is minimised (Mayer, 2024). The finding therefore indicates compatibility between the intended theoretical design and the experts' appraisal of the resulting media; it does not constitute an experimental test of CTML.

The present study extends the application of CTML to a context that combines sustainability content with vocational procedural learning. Previous multimedia research has often examined conceptual learning or general instructional video quality, whereas the present resource addresses a practice-based environmental task in cosmetology education. The contribution is therefore contextual and design-oriented: CTML principles have been translated into a concrete instructional sequence through which the environmental relevance of cosmetic waste can be explained, the 3R framework can be introduced, a recycling procedure can be demonstrated, and the resulting material can be shown in application. This provides an example of how a cognitive multimedia framework can be operationalised when learning involves both conceptual understanding and observation of a procedure. The findings are also consistent with literature indicating that instructional videos can support procedural learning by enabling learners to observe demonstrations and review specific steps (Semeraro & Turmo Vidal, 2022; Tomczyk et al., 2023). In the present study, this characteristic is particularly relevant to cosmetology education, in which practical activities form an important component of professional preparation. The video is not intended to replace direct practice or instructor supervision. Instead, it can be

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used as a supplementary visual reference through which the procedure is presented consistently and the sequence can be reviewed independently.

The study also has implications for sustainability-oriented vocational education. Environmental education may remain abstract when it is restricted to descriptions of environmental problems. By embedding the 3R principles within a practical recycling procedure, the developed resource connects environmental concepts with a vocationally recognisable activity. The practical contribution therefore does not lie in a claim that the media changes environmental behaviour; rather, it lies in providing educators with a resource through which sustainability content can be incorporated into practice-oriented learning. The same design logic may be adapted to other vocational fields in which sustainability competencies require sequential demonstrations.

From a theoretical perspective, this study contributes a conceptual framework that connects the sustainability problem of cosmetic waste with CTML-informed multimedia design, procedural demonstration, and vocational learning resources. This framework is proposed as a design-oriented conceptual contribution rather than as a tested causal model. It suggests that CTML can be used as a design lens for sustainability-oriented procedural instruction, particularly when learning materials need to coordinate explanatory content with observable actions. The contribution therefore concerns the extension of CTML application to a specific vocational and sustainability-oriented context rather than the experimental validation of CTML.

From a practical perspective, the validated video can be used as supplementary material in classroom instruction, blended learning, or independent review. Its 16:9 format and digital distribution facilitate repeated access, while the sequential demonstration can be incorporated into learning activities in which students subsequently perform recycling procedures under appropriate instructional and safety guidance. The resource may also serve as a model for lecturers who wish to develop sustainability-oriented multimedia without separating environmental education from the technical character of vocational learning.

Several limitations should be acknowledged. First, the study was conducted within a single study programme and involved a limited number of student participants. Second, the content focused specifically on powder-based cosmetic waste and its transformation into gouache paint. Third, validity and perceived practicality were assessed, but learning gains, skill performance, behavioural change, and eco-consciousness were not measured before and after use. Future research should therefore examine learning outcomes and procedural competence using experimental or quasi-experimental designs, involve broader populations, and consider other

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categories of cosmetic waste. Such research would complement the present development evidence without conflating feasibility with effectiveness.

THEORITICAL CONTRIBUTION

The primary theoretical contribution of this study lies in the contextual extension of the Cognitive Theory of Multimedia Learning to sustainability-oriented procedural learning in vocational cosmetology education. Rather than being used solely to justify the use of video, CTML was translated into specific design considerations, including coherence, signalling, segmenting, modality and synchronised narration, and cognitive load management. This approach is consistent with the growing use of CTML as a framework for designing and evaluating multimedia learning resources (Mohamed Taher et al., 2025). It provides a theoretically informed design perspective that connects multimedia cognition with vocational sustainability content. The contribution is appropriately bounded: the study does not establish the causal effectiveness of CTML or of the developed video; instead, it provides an empirically appraised example of CTML-informed instructional design.

PRACTICAL CONTRIBUTION

The practical contribution of the study is the provision of a validated instructional video that integrates cosmetic waste concepts, the 3R principles, and a step-by-step recycling demonstration. For lecturers and vocational educators, the media can serve as a supplementary resource for introducing sustainability practices within cosmetology learning. For students, it provides a reusable visual reference for reviewing the sequence of a recycling procedure. At the curriculum level, the design illustrates one approach to integrating sustainability into vocational content without treating environmental responsibility as a separate theoretical topic. The design approach may also be adapted to other practice-oriented disciplines in which learners need to understand both sustainability principles and sequential work procedures.

CONCLUSION

This study developed and validated a CTML-based instructional video for cosmetic waste recycling in vocational cosmetology education using the Four-D model. The final resource integrates environmental explanations, the 3R principles, and a sequential demonstration of the transformation of expired powder-based cosmetic waste into gouache paint for artistic application. Expert assessment yielded a material validity score of 92.92% and a media validity score of 93.64%, while the limited student practicality assessment yielded an overall score of 88.27%. Within the study context, the media was therefore judged highly valid and highly

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practical.

The contribution of the study should be understood as development and feasibility evidence rather than as evidence of effectiveness. The theoretical contribution lies in extending CTML as an instructional design lens for sustainability-oriented procedural learning in vocational education. The practical contribution lies in providing a validated supplementary learning resource and a design approach that can be adapted for sustainability-related vocational instruction. Future research should examine learning outcomes, procedural competence, and eco-consciousness using appropriate experimental designs and broader participant groups.

FUTURE DIRECTIONS

Future research should move beyond development and feasibility assessment to examine how CTML-informed sustainability videos function under instructional conditions in which learning outcomes and procedural competence are directly measured. First, experimental or quasi-experimental studies could compare CTML-informed video instruction with alternative instructional formats using pretest-posttest measures of conceptual knowledge, procedural performance, and retention. Second, future studies should examine the specific contribution of individual CTML principles through design-based comparisons rather than treating the principles as a single undifferentiated package. Third, research should assess whether repeated access to the video is associated with changes in students' ability to perform cosmetic waste sorting, recycling procedures, and related sustainability practices; such outcomes should be measured directly rather than inferred from practicality ratings. Fourth, broader samples across vocational institutions and different regions should be recruited to examine transferability beyond a single study programme. Finally, future development could expand the content to other categories of cosmetic waste and investigate whether the proposed CTML-informed design framework can be adapted to other vocational disciplines and sustainability-related practical tasks.

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