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Enhancing Students' Professional Competence Through 3D Training and Product Requirement Document Preparation

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Abstract

The digital creative industry requires vocational graduates to master technical skills and industry-standard project management. Currently, learning at SMK Telkom Purwokerto focuses heavily on academic assignments without fully integrating professional workflows like Product Requirement Documents (PRD). Consequently, students lack experience in structured project planning, scoping, and timeline execution. This community engagement program aimed to enhance students' professional competencies through a one-day intensive workshop on 3D asset production and PRD preparation, utilizing project-based learning and industry simulation. Activities included project brief simulations, group PRD drafting, 3D asset creation, and simulated client presentations. Program outcomes were evaluated using pre- and post-tests, PRD document completeness, technical asset quality, presentation performance, and participant feedback. Results demonstrated a significant improvement in participant competence, with post-test scores increasing by ≥75% over pre-test baselines, alongside fully drafted PRD documents, high-quality 3D assets, and reusable training modules with PRD templates for the partner school. Ultimately, this initiative strengthens student readiness for the creative workforce and fosters sustainable collaboration between universities and vocational schools.

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1. INTRODUCTION

SMK Telkom Purwokerto is an Information and Communication Technology (ICT)-based vocational high school in Banyumas Regency, Central Java. Operating under the Telkom education network, the institution focuses on strengthening digital competencies and graduate career readiness. The school is equipped with adequate practical facilities, including computer laboratories, high-speed internet, and specialized design and multimedia software. This digital environment serves as a crucial foundation in cultivating student competencies within visual content production and three-dimensional (3D) digital asset creation. Located at Jl. DI Panjaitan No. 128, Purwokerto Kidul, Banyumas Regency.

In curriculum implementation, instructional activities foster technical skills such as graphic design, multimedia, animation, and software development. Students are introduced to digital production software as an essential component of coursework, demonstrating initial readiness for creative industry standards. Furthermore, SMK Telkom Purwokerto holds immense potential for preparing graduates who adapt to the evolving digital sector. Supported by progressive leadership, significant room exists to elevate instruction quality, making it contextual, applied, and directly responsive to workforce requirements. Despite these strengths, reinforcing professional competencies anchored in creative industry workflows remains critical. This condition was identified during the initial needs assessment through semi-structured interviews with vocational teachers, analysis of student curriculum assignment archives, and preliminary classroom observations, which revealed that existing instructional practices tend to focus heavily on static academic assignments, failing to simulate professional environments that

demand project planning, product requirement documentation (PRD), and standardized digital asset pipelines. Consequently, establishing a strategic partnership through this community engagement program becomes highly relevant to align classroom learning with actual industry practices.

From an economic perspective, SMK Telkom Purwokerto possesses strategic potential in digital creative skills. As an ICT-focused institution, software mastery provides an opportunity to shift the learning focus toward generating economically viable digital products [1]. The broader creative industry in Indonesia has exhibited remarkable growth in gaming, animation, interactive media, and 3D visualization [2]. Operational demand for high-quality 3D assets continues to escalate, driven by mobile gaming, interactive marketing, and virtual production. Because 3D assets function as foundational building blocks within creative pipelines, demand for skilled technical artists has reached unprecedented levels [3]. Vocational high school students possess a distinct opportunity to enter the market as technical talent, freelancers, or digital creative entrepreneurs [4]. When provided with targeted instructional interventions, 3D asset production transitions from an isolated classroom exercise into a market-valued competency. Adopting project-based learning integrated with industry simulations enables students to understand the complete lifecycle of how digital products are conceptualized, authored, and communicated to meet client parameters [5].

Beyond traditional employment, mastering professional 3D asset production enables direct engagement with industry stakeholders. The global digital economy allows creative products to be distributed online, dissolving geographical constraints [6]. This open market structure allows vocational students to build competitive portfolios early while gaining experience with project-based operating models [7]. Institutionally, integrating industry-aligned instructional methods provides substantial added value. When technical proficiency in 3D creation is paired with project management literacy and formal product specification drafting, graduates emerge as profes sionally literate practitioners. This institutional potential serves as the primary driver for executing this program, ensuring vocational instruction builds productive, competitive human capital. Within practical learning, digital content creation represents a core element where students operate software to produce 3D models and composite multimedia content. Technically, students possess a functional baseline in polygonal modeling, texture mapping, rendering, and tool navigation [8].

However, current student output reveals that production remains overwhelmingly academic. Student projects are designed as localized classroom exercises that do not reflect commercial production house constraints. Digital asset creation is rarely executed within a comprehensive workflow incorporating requirement analysis, task delegation, quality assurance, or platform optimization. Fundamental industry requirements such as polycount budgets, clean topology layout, efficient UV unwrapping, and engine-ready packaging are rarely treated as mandatory parameters [9]. From a project management standpoint, instruction does not systematically incorporate formal project documentation. Students operate without exposure to standardized planning instruments such as Product Requirement Documents (PRDs), which serve as blueprints for establishing project scope, functional specifications, target user criteria, and milestone deliverables. Furthermore, practices like production scheduling, effort estimation, and client-revision loops remain absent [10].

This instructional gap causes student skill development to skew heavily toward isolated operational mechanics while leaving managerial competencies underdeveloped. In commercial creative practice, technical execution represents only one component of project success; equal weight is placed on specification compliance, scope management, and timeline adherence [11]. Consequently, a clear gap remains between practical software usage and comprehensive project management. Addressing this divide is necessary to ensure vocational learning builds true professional readiness [12]. To identify operational challenges, extensive situational analysis and preliminary field communications were conducted with the administration and teaching staff at SMK Telkom Purwokerto. From a technical production perspective, student 3D modeling activities remain detached from commercial pipeline standards. Because asset creation is initiated without reference to structured project specifications or formal PRD blueprints, students habitually begin technical execution without clear downstream

planning [13]. Crucial asset optimization practices—such as polycount budgeting and topology flow—are frequently overlooked. From a managerial perspective, students demonstrate a lack of familiarity with professional project documentation workflows. The absence of structured PRD drafting in the curriculum means students do not gain experience in defining project scope or managing production pipelines [14].

Following consultations with school leadership, the priority problem selected for direct intervention is the severe lack of integration between technical 3D asset production skills and industry-standard project management/documentation methodologies. This core issue directly impairs graduate employability and limits students' capacity to launch independent digital service ventures. Addressing this problem transforms vocational graduates from basic software operators into holistic technical professionals. This intervention leverages the university implementation team's expertise in game development, 3D art pipelines, and digital project management to link 3D asset production systematically with formal PRD documentation [15]. To resolve these priority challenges, a multi-stage intervention strategy was developed in close coordination with the school. The first solution focuses on Training on Creative Industry Workflow-Based 3D Asset Production. This module transitions students to systematic production through brief-driven pipelines, technical optimization standards (polycount budgets, clean topology, UV layout), and quality control protocols across pre-production, block-out modeling, detail refinement, and asset packaging. Targeted outputs include a training manual, optimized group 3D assets, and evaluation rubrics, with measurable indicators requiring at least 70% of participants to show pre-to-post-test score improvements and 75% of projects to meet technical standards.

The second solution encompasses Training on Product Requirement Document (PRD) Preparation, equipping students with managerial skills to draft project planning documentation. Core activities include introducing PRD frameworks, defining project scope, formulating product specifications, and constructing production timelines. Expected outputs comprise a standardized PRD template and completed group PRD documents, with target indicators requiring at least 70% of participants to achieve ≥75% completeness. The third solution centers on Implementing an Industry Simulation-Based Learning Model to provide exposure to commercial client environments. Activities involve simulated brief delivery sessions, concept presentations, structured feedback sessions, and final pitching events. This solution yields project presentation sessions, evaluation records, and a simulation framework, requiring at least 70% of participants to exhibit presentation skill growth.

Finally, the initiative is supported by the Proposing Team of faculty researchers and undergraduate students specializing in 3D graphics, game design, and digital project management. Faculty members contribute industry expertise to design training curricula, PRD templates, and simulation scenarios, while university students serve as technical teaching assistants to monitor progress and document outcomes, ensuring systematic execution for the partner institution.

2. METHOD

The implementation method of this community engagement program is systematically designed to execute the formulated solutions aimed at enhancing students' 3D asset production technical competencies and creative project management skills. The applied approach utilizes Project-Based Learning (PBL) integrated with an industry simulation model that emphasizes the synthesis of technical execution and managerial documentation. Figure 1 illustrates the structured operational workflow of the activities to be conducted:

Figure 1. Implementation Method Workflow

a. Preparation Phase

The preparation phase is initiated through preliminary coordination meetings with school leadership and department heads at SMK Telkom Purwokerto to establish the activity schedule, assess computer laboratory facility readiness, and clarify participant criteria. To ensure a representative and targeted cohort, a total of 30 vocational students specializing in digital creative skills (3D animation and multimedia production) were selected as participants through purposive sampling based on their completion of basic 3D modeling coursework, recommendation from vocational teachers, and demonstrated commitment to completing the project-based workshop. During this phase, an initial diagnostic assessment is conducted via a pre-test to capture a baseline measurement of participants' foundational technical and managerial knowledge. Simultaneously, the university engagement team compiles and refines the industry workflow-based 3D asset production training manual, standardizes the Product Requirement Document (PRD) template, and constructs comprehensive evaluation instruments, including structured technical quality and managerial completeness rubrics. This phase ensures all pedagogical tools, software environments, and instructional materials are fully prepared prior to executing the core intervention.

b. Implementation Phase

The implementation phase commences with conceptual lectures covering creative industry pipelines, technical standards for 3D asset optimization, and the structural function of Product Requirement Documents in commercial workflows. Following theoretical orientation, participants are divided into project groups and provided with simulated client briefs that serve as the foundational scope for drafting their respective PRDs. Once the PRD documentation is authored, reviewed, and approved, student teams advance to the technical 3D production stage, executing modeling, texturing, and asset optimization strictly according to their planned PRD parameters. Throughout technical execution, the university implementation team provides hands-on technical mentoring, troubleshooting, and scheduled progress monitoring. The activity culminates in a simulated project pitching and presentation session conducted in front of university mentors and partner school representatives acting as commercial clients. This session incorporates formal client feedback loops, critique, and required revision cycles prior to final asset submission. Through this multi-step process, participants gain experiential exposure that closely replicates real-world creative agency operations.

c. Partner Participation

The partner institution plays an active role in supporting the program by providing access to computer laboratories, high-speed internet infrastructure, and hardware facilities, alongside coordinating student attendance. Partner teachers actively participate throughout the training sessions, collaborating during practical workshops and assisting with classroom management. Furthermore, partner representatives are directly involved in evaluation sessions and project presentation reviews as co-assessors. This active institutional participation ensures that the instructional outcomes, workflows, and pedagogical methodologies can be sustainably integrated into the school’s ongoing curriculum.

d. Program Evaluation

Program evaluation is conducted comprehensively to measure competency growth and project quality across distinct assessment levels. Quantitative analysis compares pre-test and post-test scores administered individually to evaluate each student's personal growth in technical and conceptual knowledge. In contrast, the evaluation of PRD documents and 3D asset submissions is conducted at the group level, as these outputs are collaboratively produced by small student project teams (consisting of 5–6 students per group). These group-based deliverables are evaluated using standardized, structured rubrics measuring technical compliance, topology efficiency, document completeness, and specification adherence. The evaluation framework also incorporates direct observation of group project presentation and communication capabilities during client simulation pitching events, alongside individual participant and partner satisfaction surveys. All collected evaluation metrics are analyzed descriptively to measure achievement against predefined performance indicators.

e. Program Sustainability

To ensure long-term educational impact, the complete training manual, PRD template guidelines, and evaluation rubrics are formally handed over to SMK Telkom Purwokerto for continued adoption as institutional instructional assets. The industry simulation model implemented during the program is recommended for integration into the school's broader project-based learning curriculum. Furthermore, the university engagement team maintains opportunities for ongoing technical consultation and follow-up mentoring, fostering a sustainable collaborative network between higher education institutions and vocational education partners.

3. RESULTS AND DISCUSSION

The community engagement program titled "Enhancing Vocational Students' Professional Competencies through 3D Asset Production Training and Industry-Based Product Requirement Document Preparation" at SMK Telkom Purwokerto has been systematically implemented. The activity involved 30 student participants and was presented by Dani Arifudin, M.Kom., accompanied by a mentoring team from Universitas Amikom Purwokerto.

a. Preparation Phase Results

During the preparation phase, the engagement team conducted technical coordination meetings with the school management and teaching staff at SMK Telkom Purwokerto to agree on the implementation schedule and verify computer laboratory and internet network readiness. Prior to the intervention, the 30 participants completed a pre-test session to measure their initial understanding of 3D asset production and project documentation. Pre-test results indicated that participants' initial knowledge was primarily limited to basic software operations without familiarity with creative industry workflows or Artificial Intelligence (AI) integration. Additionally, the team successfully compiled the AI-based 3D asset production training manual, PRD instructional module, supporting document templates, and structured technical/managerial evaluation rubrics.

b. Implementation Phase Results

The implementation phase was executed through a series of intensive lectures and hands-on practical workshops. During the 3D asset production sessions, students were introduced to Artificial Intelligence (AI) integration to accelerate creative pipelines using platforms such as Tripo AI, Meshy AI, and Seedance. Students practiced utilizing AI tools across idea exploration, concept development, and efficient 3D digital asset creation. The hands-on technical mentoring provided by the university team during 3D asset production is shown in Figure 2.

Figure 2. Hands-On Practical Training using AI Platforms for 3D Asset Production

In the project management and Product Requirement Document (PRD) preparation sessions, the training extended beyond asset creation to equip students with professional service workflows used in creative industries. Students were guided to draft standard industry project documentation, including

1) Project Proposal: Formulating core project concepts and scope boundaries.
2) Cooperation Agreement: Understanding legal aspects and operational commitments.
3) Timeframe Mapping & Quotation: Scheduling production pipelines and cost estimation.
4) Licensing: Comprehending intellectual property rights and digital asset licensing.
5) Handover Minutes (BAST): Executing formal project deliverable protocols

The activities culminated in a simulated project pitching session where student groups presented their PRD documentation and 3D asset outputs to the engagement team acting as commercial clients. This session concluded with structured feedback and revision cycles to simulate real-world industry dynamics. The execution of the project presentation and review session is presented in Figure 3.

Figure 3. Simulated Project Presentation and Student PRD Review Session

c. Partner Participation Results

SMK Telkom Purwokerto actively participated by providing well-equipped computer laboratory facilities and coordinating the full attendance of all 30 student participants. Partner teachers attended the sessions to observe the AI-integrated and PRD-based learning workflows. Furthermore, partner representatives actively engaged in assessing student groups during the project presentation simulations. This active institutional involvement strengthens teacher capacity to sustainably adopt the training modules into ongoing classroom instruction.

d. Program Evaluation Results

Program evaluation was conducted comprehensively to measure learning effectiveness and project quality, aligning directly with the predefined performance indicators:

1) Technical and Managerial Competency Growth: Individual evaluation revealed a clear baseline growth across pre- and post-test measurements. The mean pre-test score across all 30 participants was 48.50 (SD = 7.20), reflecting baseline familiarity limited to basic software tools without standardized industry workflows. Following the workshop intervention, the mean post-test score increased significantly to 86.20 (SD = 5.40), representing a 77.73% relative increase in average test performance. Furthermore, 83.3% of individual participants (25 out of 30 students) achieved post-test scores meeting or exceeding the target benchmark of 75.00, demonstrating substantial individual knowledge acquisition in AI-assisted 3D asset creation, PRD drafting, and project estimation.
2) Product and Documentation Quality: At the group level, 100% of student projects (5 out of 5 groups) successfully met the established technical quality and documentation completeness standards, delivering complete PRD packages (proposals, timeframes, licensing, and BAST drafts) alongside 3D assets optimized to specified topology and polycount budgets.
3) Simulation Performance and Participant Satisfaction: Evaluation of the pitching sessions indicated that 80.0% of participants (24 out of 30 students) exhibited observable improvement in project presentation skills when presenting deliverables to the simulated client panel. Additionally, satisfaction surveys revealed that ≥85% of participants rated the training as highly valuable for enhancing professional work ethics and career readiness, while partner school leadership expressed high satisfaction with the overall program outcomes.

e. Program Sustainability Results

To ensure long-term educational impact, the Universitas Amikom Purwokerto team formally handed over the AI-based 3D asset production training manual and master PRD templates to SMK Telkom Purwokerto. These instructional materials were transferred so that school faculty can reuse them in future Project-Based Learning (PBL) courses. Additionally, both institutions agreed on potential follow-up mentoring and continued collaboration to support ongoing digital technology and AI adoption within the school. The symbolic handover of instructional materials and the group photograph with all participants are shown in Figure 4.

Figure 4. Group Photo with Participants

4. CONCLUSION

The community engagement program at SMK Telkom Purwokerto successfully addressed the priority challenge of bridging vocational students' technical skills with creative industry-standard workflows and project management practices. Through an integrated approach combining AI-assisted 3D asset production training, Product Requirement Document (PRD) preparation, and industry-simulated pitching, the initiative achieved significant quantitative and qualitative outcomes. Participants

demonstrated a substantial average knowledge gain exceeding 75% between pre-test and post-test assessments, accompanied by a 100% completion rate for both optimized 3D assets and comprehensive PRD documentation packages. By mastering platform workflows such as Tripo AI, Meshy AI, and Seedance, alongside formal documentation tools like project proposals, timeframe mapping, licensing, and handover protocols, students transitioned from basic software operators into market-ready technical talent.

Beyond direct student outcomes, the active collaboration with partner teachers and school leadership strengthened institutional capacity for sustainable educational transformation. Handing over the comprehensive training modules, master PRD templates, and evaluation rubrics provides SMK Telkom Purwokerto with replicable resources for future project-based learning curricula. To maximize long-term impact, it is recommended that the school officially integrate the industry simulation framework into its core vocational coursework and expand partnerships with creative industry stakeholders. Furthermore, future higher education engagements can build upon this foundation by offering advanced training modules focused on specialized real-time engine deployment, interactive technical art, and digital service freelancing strategies.

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