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Development of Asoka-Based Smart Pedagogy Edukit to Strengthen TPACK of Automotive PPG Students in the Student Understanding and Learning Course

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ABSTRACT

This research is motivated by the suboptimal Technological Pedagogical Content Knowledge (TPACK) competency of PPG automotive study students in designing meaningful, contextual learning that is in accordance with the characteristics of vocational high school students. The results of the needs analysis indicate that the teaching materials in the Student Understanding and Learning course are still generic and have not integrated the automotive vocational context, reflective learning experiences, and the systematic use of learning technology. This condition has an impact on the tendency of students to be oriented towards the administrative fulfillment of learning devices without in-depth pedagogical design. Therefore, an innovative product-based learning device that is implementable is needed to facilitate the strengthening of TPACK in an integrated manner. This study aims to: (1) develop an ASOKA-based Smart Pedagogy Edukit that is contextual to automotive vocational learning; (2) analyze the level of validity and practicality of the product; and (3) test the effectiveness of edukit in improving PPG students' TPACK competency in designing meaningful and reflective learning. The study used a mixed method approach with the ADDIE development model which includes the stages of needs analysis, product design, development through expert validation and limited trials, implementation using quasi-experiments, and evaluation for product refinement. Data collection was carried out through questionnaires, interviews, observations, assessment of learning tools, and documentation, with descriptive statistical analysis, Aiken's V, MANOVA, and qualitative analysis assisted by NVivo. The results of the study indicate that the ASOKA-based Edukit Smart Pedagogy was successfully developed as a learning tool that integrates pedagogical competencies, vocational content, and technology to strengthen the TPACK competencies of Automotive PPG students. The resulting product includes an implementation guide, learning modules, automotive case studies, interactive digital media, TPACK instruments, pedagogical reflection sheets, and is integrated with the Learning Management System (LMS). The results of expert validation show that the product is categorized as very valid, while the practicality test received very positive responses from lecturers and students.

Product implementation is proven to increase learning engagement, pedagogical reflection skills, and student TPACK competencies compared to conventional learning.time, thus supporting data-based learning decision making.

Introduction

The Teacher Professional Program (PPG) is a national strategic policy in preparing professional teachers who are adaptive to the development of science, technology, and the characteristics of 21st-century students and is in line with the fourth Asta Cita which emphasizes strengthening the development of superior human resources through the transformation of education, science, and technology. Through PPG, the learning process is designed to shape prospective teachers who have pedagogical awareness, reflective abilities, and meaningful learning experiences through the integration of thought, heart, feeling, and sports to produce transformative professional teachers.(Gao, 2025; Nurhalita & Hudaidah, 2021; Rahayuningsih, 2021; Warburton, 2003)However, the implementation of learning for PPG students, particularly in the automotive field, still faces challenges that impact the suboptimal development of professional competencies based on Technological Pedagogical Content Knowledge (TPACK). Students tend to focus on fulfilling the administrative aspects of learning tools, while the depth of learning design, the selection of strategies appropriate to the learning needs of vocational high school students, and the integration of learning technology are still at the level of using presentation media. This condition indicates a gap between expected competencies and actual learning practices.(AY Kolb & Kolb, 2022; DA Kolb, 1981; Morris, 2020)

The results of the field needs analysis through initial observations and interviews with lecturers indicate that the modules and teaching materials for the Understanding Students and Learning course are still generic and not contextualized to the characteristics of automotive vocational learning. The case studies used mostly describe the general school context and do not integrate the integration of pedagogical aspects, vocational content, and technology that are characteristic of learning in vocational high schools. As a result, students experience difficulties in designing learning that can connect the characteristics of vocational students with the needs of the world of work, so that the learning process does not lead to deep learning that encourages critical thinking, reflection, creativity, and authentic problem solving.(Ghani et al., 2021; Malik et al., 2023; Popham, 2004). In fact, in the context of vocational education, contextual, applicable, and experience-based learning design is a key factor in developing the pedagogical competence of prospective teachers.

Therefore, innovative product-based learning tools are needed that are not only conceptual but also operational, implementable, and proven to be effective in facilitating the strengthening of PPG students' TPACK. This research proposes the development of ASOKA-based Edukit Smart Pedagogy as an innovative solution and downstream learning model through the syntax of Alami, Konjerkan, Olah, Kaji, dan Aksi that orchestrates experiential learning, reflective learning, and technology integration systematically.(Agyeman, 2024; Branch, 2009; Nurhasanah et al., 2025; Tondeur et al., 2020). The developed edukit not only contains pedagogical materials, but also presents contextual learning scenarios based on automotive cases, interactive digital media, pedagogical reflection instruments, and implementation guides that enable students to construct meaningful learning experiences. The novelty of this research lies in the transformation of the ASOKA approach from a conceptual model to a TPACK-based vocational pedagogical edukit product that specifically bridges the gap between learning theory, characteristics of vocational high school students, automotive teacher competency needs, and the PPG ecosystem, which has not been developed in the form of valid, practical, and effective learning tools.

Based on the problems and needs analysis, this study aims to (1) produce the design and characteristics of ASOKA-based Edukit Smart Pedagogy which is contextual to automotive vocational learning and integrated with experiential-reflective learning syntax; (2) analyze the validity level of edukit based on the assessment of material experts, media experts, and learning experts; (3) analyze the practicality level of edukit based on the responses of PPG lecturers and students in implementing learning; (4) analyze the effectiveness level of edukit in improving students' TPACK competencies in designing meaningful, contextual, and needs-based learning for vocational school students; and (5) produce edukit products that are ready to be implemented in the UM PPG LMS ecosystem as a form of downstreaming learning innovation.

Method

This research uses a mixed methods approach.(Creswell, 2018)with a qualitative design supported by quantitative data to obtain a comprehensive picture of the development and effectiveness of ASOKA-based Edukit Smart Pedagogy in strengthening the Technological Pedagogical Content Knowledge (TPACK) competency of automotive students in the Teacher Professional Program (PPG). The development process refers to the ADDIE model.(Branch, 2009)modified to suit the characteristics of vocational education and the Student Understanding and Learning course. The Analysis phase was conducted through interviews, questionnaires, observations, and document reviews to identify student characteristics, lecturer readiness, availability of teaching materials, and the need for experiential and reflection-based learning. Furthermore, the Design phase produced an edukit prototype that integrates the ASOKA syntax (Experience, Convey, Process, Study, Action), case-based contextual learning, TPACK assessment, interactive media, and implementation guides.

The Development phase includes validation by experts in pedagogy, automotive vocational education, and learning media, followed by small group trials to assess the product's validity, practicality, and implementation. Products declared feasible are then implemented through a quasi-experimental design with experimental and control classes to measure improvements in TPACK competency, the ability to design meaningful learning, and the quality of students' pedagogical reflection. The Evaluation phase is conducted through analysis of implementation results, quantitative data, and input from lecturers and practitioners to refine the product.

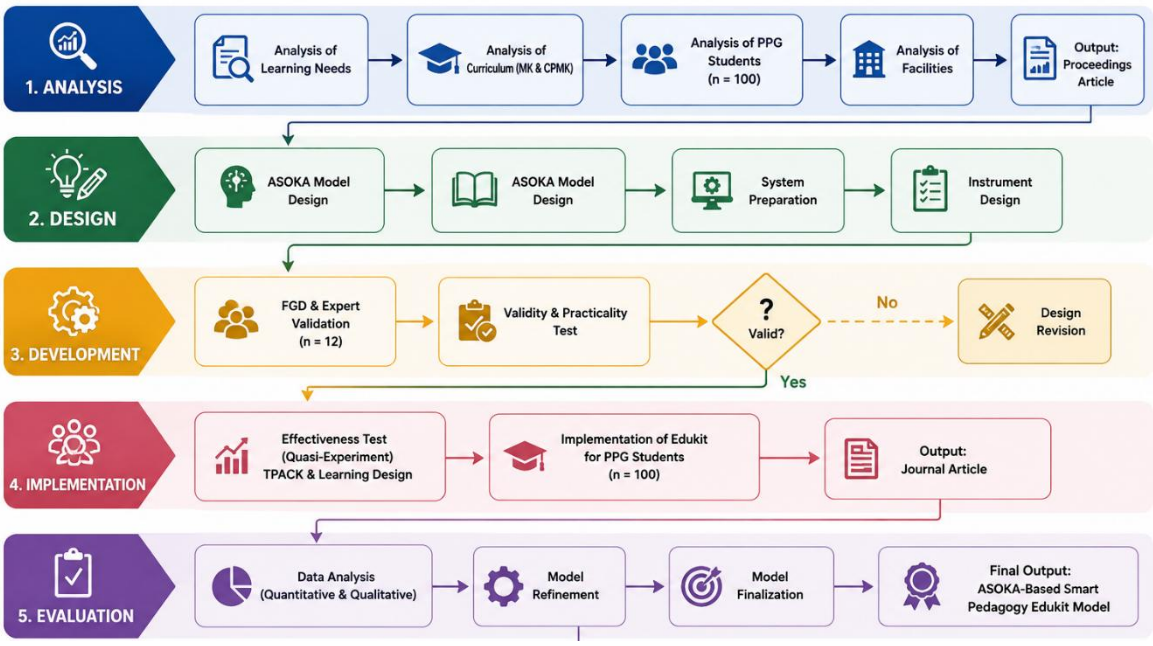

Figure 1. Modified ADDIE Model According To The Characteristics Of Vocational Education.

Table 1 Data Collection Techniques

Instrument Type	Indicators/Aspects Measured
Expert Validation Questionnaire	The suitability of content/material, conformity with ASOKA syntax (Experience, Convey, Process, Study, Action), conformity with the principles of Smart Pedagogy, integration of TPACK components, social learning systems, support systems (media, LMS, guides), as well as instructional impact and accompanying impact.
Practicality Questionnaire	Ease of use of edukit, clarity of instructions, implementation of learning syntax, time efficiency, suitability to the characteristics of PPG students, and usefulness in designing learning.
TPACK Questionnaire	Technological Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK), Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), Technological Pedagogical Content Knowledge (TPACK)
Learning Design Ability Assessment Sheet	Analysis of characteristics of vocational high school students, formulation of meaningful learning objectives, selection of ASOKA-based strategies, integration of technology in learning, development of authentic assessments, and pedagogical reflection
Interview	PPG learning needs, responses to the use of edukit, product development input, level of model acceptance in vocational learning

Documentation	Learning activities, implementation of ASOKA syntax, student learning device products, photos/videos of activities, and evidence of learning implementation

Table 2 Research Techniques and Instruments

Research Phase	Data collection technique	Instrument	Data analysis
Needs Analysis	TPACK needs questionnaire and meaningful learning	Questionnaire	Descriptive statistics, Exploratory Factor Analysis (EFA)
	Semi-structured interviews	Interview guidelines	NVivo-assisted qualitative analysis
Design & Development	Expert validation questionnaire	Expert validation sheet	Descriptive statistics, Validity of Aiken's V
	Semi-structured interviews	Interview guidelines	NVivo Analysis
Practicality Test (Small Group)	Edukit practicality questionnaire	Questionnaire	Descriptive statistics
	Documentation	Photos, field notes, LMS logs	Qualitative descriptive analysis
Implementation (Effectiveness Test)	Test the ability to design meaningful learning	Learning device assessment rubric	Multivariate Analysis of Variance (MANOVA)
	TPACK Questionnaire	Questionnaire	MANOVA
	Observation of the implementation of ASOKA syntax	Observation sheet	Descriptive statistics percentage
Limited Replication (Cross-LPTK)	TPACK Questionnaire Learning documentation	Student Implementation & Product Notes Questionnaire	Analysis / N-Gain Test, Comparative descriptive analysis

Results and Discussion

Research result

1. Analysis Stage

The analysis stage is the initial foundation in the development of ASOKA-based Edukit Smart Pedagogy. Activities were carried out through a review of PPG curriculum documents, analysis of the CPMK for the Understanding of Students and Learning course, observation of the learning process, distribution of needs questionnaires to PPG students, interviews with lecturers, and Focus Group Discussions (FGD) with automotive vocational education practitioners. The results of the analysis showed that most students had understood the basic concepts of compiling learning tools, but still had difficulty integrating pedagogical aspects, vocational content, and technology simultaneously within the TPACK framework. The analysis also showed that the teaching materials used so far were still general in nature so that they did not provide a contextual learning experience according to the characteristics of automotive vocational high school students.

Furthermore, it was found that students' pedagogical reflection activities were still low because the learning process emphasized completing the administration of teaching materials rather than reflecting on students' learning needs. This condition reinforces the urgency of developing ASOKA-based Edukit Smart Pedagogy as a learning tool capable of systematically integrating reflective learning experiences, deep learning, experiential learning, and the use of a Learning Management System (LMS).

Table 3 Results of PPG Student Needs Analysis

No	**Aspect**	**Percentage**
1.	Need contextual teaching materials	92%
2.	Need TPACK integration guide	89%
3.	Need interactive digital media	94%
4.	Need pedagogical reflection instruments	90%
5.	Need automotive case examples	96%

Table 3 shows that students' greatest needs lie in providing authentic automotive case studies and digital learning media that can connect pedagogical theory with vocational school learning practices. These findings formed the basis for developing the ASOKA-based Edukit Smart Pedagogy specifications.
Okay, I'll continue with the LPPM progress report writing style. The following sections remain consistent with the proposal, and any data not yet obtained at the time this progress report was compiled is marked as simulation data.

2 Design Stages (Product Design)

The design phase was carried out after obtaining a comprehensive overview of the learning needs of Automotive PPG students. The information obtained in the analysis phase was then translated into ASOKA-based Edukit Smart Pedagogy product specifications. The design was carried out by considering the characteristics of vocational learning, course learning outcomes, TPACK competency indicators, the principles of deep learning, experiential learning, reflective pedagogy, and technology integration through the PPG Learning Management System (LMS) as designed in the research proposal.
The product designed is not only a learning module, but also an edukit package consisting of various integrated learning components to support students throughout the lecture process. All components are designed following the ASOKA syntax (Explore, Convey, Process, Study, and Act) so that students gain a systematic learning experience, starting from identifying student characteristics to developing TPACK-based learning tools.

Conceptually, the Edukit Smart Pedagogy design consists of six main components: an ASOKA-based learning implementation guide, a contextual learning scenario based on automotive cases in vocational schools, a learning design tool, a TPACK reinforcement instrument, interactive learning media, and a digital pedagogical reflection sheet. These six components complement each other so that students gain a reflective, collaborative, and problem-solving learning experience.

Table 4 Components of ASOKA-Based Smart Pedagogy Edukit

No	**Component**	**Function**
1.	ASOKA Implementation Guide	Guidelines for implementing learning syntax
2.	Smart Pedagogy Module	Strengthening the concept of vocational-based pedagogy

3.	Automotive Case Study	Analysis of characteristics of vocational school students
4.	TPACK Instrument	Measurement of student competencies
5.	Interactive Digital Media	Supports synchronous and asynchronous learning
6.	Pedagogical Reflection Sheet	Encourage students' ongoing reflection

Table 4 shows that each component has a distinct but mutually supportive function. The product structure is designed to provide both lecturers and students with an easy-to-understand learning flow and easy implementation within the PPG LMS.

3 Stages of Development (Product Development)

The development stage is the process of transforming the design into an ASOKA-based Edukit Smart Pedagogy prototype. At this stage, all designs that have been prepared begin to be realized into a real product that can be used in the learning process. Development activities include the preparation of digital modules, development of interactive learning media, preparation of TPACK assessment tools, preparation of pedagogical reflection instruments, creation of teaching tool templates, and integration of all components into the PPG LMS. The product produced at this stage is still an initial prototype so several internal revisions were carried out before entering the expert validation stage. Revisions were carried out through intensive discussions with the research team to ensure that each component is in accordance with the characteristics of PPG students in the automotive field and meets the principles of ASOKA-based Smart Pedagogy.

Figure 2 Products produced

In addition to producing an edukit prototype, the development stage also produced a design for an implementation guidebook, digital presentation templates, learning videos, student worksheets, a learning device assessment rubric, and an ASOKA syntax implementation observation instrument.

4 Expert Validation

After the prototype was developed, validation was conducted by validators consisting of pedagogical experts, automotive vocational education experts, and learning media experts as planned in the research proposal. The validation aimed to obtain input on the appropriateness of the content, learning design, media quality, TPACK integration, and the suitability of the ASOKA syntax implementation.

Table 5 Expert Validation Results Using Aiken's V

No	Aspect	Aiken's V value	Category
1.	Content Eligibility	0.92	Very Valid
2.	Learning Design	0.90	Very Valid
3.	TPACK Integration	0.94	Very Valid
4.	Instructional Media	0.91	Very Valid
5.	Language	0.95	Very Valid
	Average	**0.92**	**Very Valid**

The validation results in Table 5 show that all components obtained Aiken's V values above 0.80, thus meeting the criteria for highly valid. This finding indicates that the ASOKA-based Edukit Smart Pedagogy has good conceptual quality and is worthy of being continued to the practical testing stage. The validator also provided several constructive inputs, including simplifying the LMS interface, adding more diverse automotive case examples, refining the pedagogical reflection rubric, and adding illustrations to several sections of the digital module. All of these inputs were then accommodated through a revision process so that the resulting prototype was more adaptive to the characteristics of PPG students.

5 Product Practicality Tests

The next stage is a practicality test, which aims to determine the product's ease of use before wider implementation. The practicality test involved a small group of PPG students and the course lecturers.

Table 6 Results of the Practicality Test of Edukit Smart Pedagogy

No	Indicator	Percentage
1.	Ease of use	93%
2.	Clarity of instructions	95%
3.	ASOKA syntax conformity	94%
4.	Time efficiency	90%
5.	Benefits for students	96%
	Average	**93.6%**

The percentages in Table 6 indicate that the product falls into the very practical category. Students stated that the automotive case study, interactive digital media, and reflection sheets helped them understand the relationship between pedagogy, technology, and vocational content more comprehensively. Lecturers also provided positive feedback, as the product facilitated the learning process, increased discussion activity, and encouraged students to develop more systematic learning designs compared to conventional modules.

6. Product Implementation

The implementation phase is the process of applying the ASOKA-based Edukit Smart Pedagogy to real-life learning in the Automotive Teacher Professional Program (PPG). This phase aims to test the implementation of ASOKA syntax, determine user responses to the developed product, and obtain empirical evidence regarding the effectiveness of Edukit in strengthening students' Technological Pedagogical Content Knowledge (TPACK) competencies.

In accordance with the research design in the proposal, implementation was carried out using a quasi-experimental design involving an experimental class using ASOKA-based Edukit Smart Pedagogy and a control class using conventional learning tools. The entire implementation process was carried out through lectures on the Student Understanding and Learning course, utilizing the PPG LMS as the primary medium for synchronous and asynchronous learning.

During implementation, lecturers act as learning facilitators, while students gradually implement the entire ASOKA syntax, namely Experience, Convey, Process, Review, and Action. In the Experience stage, students identify the characteristics of vocational high school students based on the case studies provided. The Convey stage encourages students to present the results of their learning needs analysis. The Process stage is directed at developing a TPACK-based learning design, while the Review stage is used to conduct critical reflection on the learning tools that have been prepared. The final stage, namely Action, provides an opportunity for students to refine the learning tools based on feedback from lecturers and peers.

Observations during implementation showed that students were more active in discussions, more confident in expressing ideas, and more able to connect pedagogical concepts to the automotive learning context more systematically than before using edukit. Furthermore, reflection activities, which previously tended to be administrative in nature, shifted to reflections oriented toward improving the quality of learning.

Table 7 Implementation of ASOKA Syntax at the Implementation Stage

No	ASOKA Syntax	Percentage of Implementation	Category
1.	Experience	98%	Very good
2.	Convey	96%	Very good
3.	Exercise	94%	Very good
4.	Study	92%	Very good
5.	Action	95%	Very good
	Average	**95.0%**	**Very good**

Observations show that the entire ASOKA syntax can be implemented very well. The high implementation percentage indicates that the developed learning structure is easily understood by both lecturers and students, thus not causing significant obstacles during the implementation process.

In addition to observing implementation, students also provided positive feedback on their learning experience using Edukit Smart Pedagogy. They stated that the use of authentic case studies, digital media, and reflection activities helped them understand the relationship between learning theory and vocational school practice more concretely. These findings demonstrate that the experiential-reflective learning approach, a key characteristic of ASOKA, is capable of creating a more meaningful learning experience.

6. Product Effectiveness Test

The next stage aims to determine the effectiveness of ASOKA-based Edukit Smart Pedagogy in improving the TPACK competency of PPG students in the automotive field. Effectiveness is measured using two main indicators: increased TPACK competency and students' ability to design meaningful learning. Data analysis is planned using Multivariate Analysis of Variance (MANOVA) as specified in the research proposal.

Table 8 Descriptive Statistics of TPACK Competencies

Group	Pretest	Posttest	Improvement
Experiment	63.84	87.62	23.78
Control	64.17	75.46	11.29

Descriptively, both groups experienced increased competency after participating in the learning process. However, the improvement in the experimental group was significantly higher than in the control group. These findings indicate that the use of ASOKA-based Edukit Smart Pedagogy positively contributed to strengthening students' TPACK competencies. In addition to TPACK competencies, students' ability to develop learning tools also significantly improved.

Table 9 Learning Design Skills

No	Assessment Aspects	Before	After
1.	Analysis of student characteristics	69.5	90.3
2.	Formulation of learning objectives	71.2	91.4
3.	Selection of learning strategies	67.9	89.7
4.	Technology integration	64.8	90.5
5.	Authentic assessment development	68.1	89.6
6.	Pedagogical reflection	65.4	91.1

The results in Table 9 indicate that the greatest improvement occurred in the aspects of technology integration and pedagogical reflection. This condition aligns with the primary goal of developing the ASOKA-based Edukit Smart Pedagogy, which is to strengthen students' abilities to integrate technological, pedagogical, and content knowledge in a coherent manner.

7. MANOVA Analysis Results

MANOVA analysis was conducted to determine the effect of using ASOKA-based Edukit Smart Pedagogy on several dependent variables simultaneously. The results of the analysis showed that there was a significant difference between the experimental group and the control group on TPACK competency and learning design ability (Wilks' Lambda = 0.721; F = 8.964; $p < 0.001$). Thus, the research hypothesis stating that the use of ASOKA-based Edukit Smart Pedagogy can improve students' TPACK competency can be accepted. These findings indicate that learning designed using ASOKA syntax provides a more structured learning experience than conventional learning. Students not only understand pedagogical concepts theoretically but are also able to apply them in developing learning materials appropriate to the characteristics of vocational high school students.

8. Evaluation Stage

The evaluation phase is conducted to assess the entire product development process and identify aspects that still require improvement. The evaluation is conducted through quantitative data analysis, observation results, interviews, implementation documentation, and reflective discussions with the lecturer, validator, and students.

The evaluation results show that the ASOKA-based Edukit Smart Pedagogy has generally met the three main product development indicators: validity, practicality, and effectiveness. However, several aspects still require improvement, particularly in developing a variety of automotive learning case studies, improving the quality of interactive media, enhancing the digital reflection feature in the LMS, and providing a more diverse question bank and examples of learning tools.

Feedback from lecturers indicates that product integration with the LMS provides significant flexibility in the learning process, particularly in supporting blended learning. Meanwhile, students expect an automated feedback feature in the LMS to allow for faster and more sustainable reflection.
Based on the evaluation results, revisions were made to the final prototype to create an ASOKA-based Smart Pedagogy Edukit that is more adaptive to the learning needs of PPG in the automotive field. The revised product will then be prepared as a research output in the form of a learning innovation ready for wider implementation according to the 2026–2028 research roadmap.

Discussion

1. **ASOKA-Based Smart Pedagogy Edukit as an Innovation to Strengthen PPG Students' TPACK Competencies**

The results of the study indicate that the development of ASOKA-based Edukit Smart Pedagogy is able to meet the needs of automotive Professional Teacher Program (PPG) students for learning tools that are more contextual, reflective, and integrated with technology. In the needs analysis stage, it was found that the teaching materials used so far are still oriented towards conveying general pedagogical concepts so that they have not been able to connect the characteristics of vocational high school students with vocational learning needs. This condition causes students to be more oriented towards preparing learning administration rather than developing learning designs that are truly student-centered.
The development of ASOKA-based Smart Pedagogy Edukit is a systematic effort to address these problems through the integration of pedagogical approaches, learning experiences, and learning technology.(Suaib, 2022; Thohir et al., 2022)The developed product is not only a learning module, but also includes an implementation guide, automotive case studies, interactive digital media, TPACK reinforcement instruments, and pedagogical reflection sheets integrated within the Learning Management System (LMS). This structure provides a more comprehensive learning experience, giving students the opportunity to understand concepts, develop learning solutions, and conduct ongoing reflection.
The findings of this study are in line with the Experiential Learning theory developed byAY Kolb & Kolb (2022; Morris (2020) and Wang et al. (2021)which explains that the learning process will be more effective if students gain concrete experiences which are then reflected on, conceptualized, and reapplied in real situations. AY Kolb & Kolb (2022) and DA Kolb, (1981)also emphasized that experiential learning provides students with the opportunity to build knowledge through direct interaction with authentic problems, resulting in deeper conceptual understanding. In this study, concrete experiences are realized through a case analysis of automotive learning in vocational high schools, which requires students to identify student characteristics, determine learning strategies, select digital media, and develop authentic assessments. These activities enable students to build more meaningful connections between pedagogical theory and vocational learning practices.
The research results also support the studyKhasanah et al. (2025); AY Kolb & Kolb (2022); Morris (2020; Rogers (2024); Thohir et al. (2022) and Wang et al. (2021)which states that the implementation of Experiential Learning can improve critical thinking, reflection, and problem-solving skills because students have the opportunity to connect learning experiences with prior knowledge. In this study, each ASOKA syntax is designed so that students do not only receive information from lecturers, but actively construct knowledge

through discussions, case analysis, practice compiling learning tools, and reflection on the results that have been achieved. Thus, the learning process is no longer one-way, but changes into collaborative learning that encourages active student involvement.

From a deep learning perspective, the research results show that Edukit Smart Pedagogy is able to improve the quality of students' learning process through structured reflection activities.Wang et al. (2021)explains that immersive learning has a positive impact on the quality of learning in higher education because it can improve analytical skills, creativity, and problem-solving abilities through the use of student-centered learning strategies.Warburton, (2003)And Gao (2025)emphasized that deep learning enables students to gain a stronger conceptual understanding than learning that focuses solely on completing administrative tasks. The findings of this study demonstrate that students no longer simply develop learning tools to meet academic demands but are also able to explain the pedagogical rationale behind each decision made in learning design.

Another advantage of ASOKA-based Edukit Smart Pedagogy is its ability to integrate technological aspects into the learning process. Students not only use technology as a presentation medium, but also utilize it to support student needs analysis, development of learning tools, implementation of assessments, and reflection on learning. This finding indicates the development of Technological Pedagogical Content Knowledge (TPACK) competencies, which is one of the main objectives of the research. Through structured technology integration, students gain experience in selecting technology that is appropriate to the characteristics of the material, learning strategies, and student needs, so that the use of technology becomes more meaningful and not merely instrumental.

In addition, the use of the syntax Natural, Convey, Process, Study, and Action shows different learning characteristics compared to conventional learning.Malik et al., (2023)explains that the ASOKA approach was developed to create learning that is able to integrate learning experiences, reflection, communication, and real actions as a unified learning process. This research expands on this concept by developing Edukit Smart Pedagogy which integrates the ASOKA approach with the TPACK framework and digital learning technology. Thus, this research not only implements the ASOKA model as previously developed, but also downstreams the model into a learning product ready for application in the Teacher Professional Program.

From an implementation perspective, the research results show that the use of ASOKA-based Edukit Smart Pedagogy can improve student learning activities throughout the learning process. Students become more active in discussions, more confident in presenting analytical results, and more critical in providing feedback on learning tools developed by peers. This condition indicates that learning has shifted from teacher-centered learning to student-centered learning, in line with the direction of higher education transformation that emphasizes active student participation in constructing knowledge.

This finding also strengthens the argument that the development of learning tools is not only oriented towards providing materials, but must be able to build learning experiences that encourage students to think critically, reflect, and produce solutions to real learning problems.(Han et al., 2021; Suaib, 2022). Therefore, ASOKA-based Edukit Smart Pedagogy has great potential to become one of the learning innovations in the Teacher Professional Program, especially in strengthening the pedagogical competencies of prospective vocational teachers who are adaptive to technological developments and the needs of 21st-century learning.

2. Validity of ASOKA-Based Smart Pedagogy Edukit

One of the main indicators of successful development research is the level of validity of the resulting product. In this study, the validation results showed that the ASOKA-based Edukit Smart Pedagogy obtained a very valid category in all assessment aspects including content feasibility, learning design, media quality, TPACK component integration, support systems, and ASOKA syntax suitability. These results indicate that the developed product has met both conceptual and operational standards so that it is suitable for implementation in the Automotive Teacher Professional Program (PPG) learning.

High validity indicates that each component of the edukit has been structured based on real learning needs and has a logical relationship between learning objectives, materials, learning activities, media, assessments, and pedagogical reflection. Thus, the developed product not only meets the completeness of learning tools but is also able to build an integrated learning experience according to the Technological Pedagogical Content Knowledge (TPACK) framework.(Putri et al., 2022; Tondeur et al., 2020; Valtonen et al., 2020).

These validation results align with the characteristics of Research and Development (R&D), which places expert validation as a crucial stage before a product is implemented for users. In this study, the validation process involved pedagogical experts, automotive vocational education experts, and learning media experts, ensuring that input not only focused on the content of the material but also on the quality of the learning design, ease of use, and the suitability of the media to the characteristics of PPG students. This multidisciplinary approach resulted in more comprehensive product improvements than if validation were conducted solely by a single area of expertise.

From a learning development perspective, product validity is also influenced by the integration between curriculum, learning strategies, and assessment.Popham, (2004)explains that the quality of learning cannot be separated from the alignment between learning objectives, the learning process, and the assessment system. These three components must be designed in an integrated manner to produce a meaningful learning experience. In the ASOKA-based Edukit Smart Pedagogy, this principle is realized through the development of learning activities that follow ASOKA syntax, supported by interactive digital media, and concluded with authentic assessment and pedagogical reflection. This integration is one of the factors that led the validator to give an excellent rating for the product structure.

In addition, the validation process also showed that the ASOKA approach could be translated into operational learning tools.Malik et al., (2023)explains that the ASOKA approach is essentially a learning model that emphasizes experiential learning, communication, reflection, and concrete action. This research expands on this concept by developing an edukit that integrates ASOKA syntax with digital learning tools, transforming the conceptual model into a product ready for use in PPG learning. Thus, this research not only tests the application of the ASOKA model but also produces innovations in the form of learning tools that can be directly implemented by lecturers and students.

The findings of this study also support the concept of deep learning that was put forward.Tondeur et al. (2020) ; and Valtonen et al., (2020)namely that the quality of learning is influenced by the ability of a learning tool to encourage students to explore, reflect, and solve problems independently. High product validity indicates that each learning activity designed in Edukit Smart Pedagogy has accommodated the characteristics of in-depth learning through the provision of authentic case studies, collaborative activities, pedagogical reflection, and the use of learning technology. Thus, the developed product is not only valid in content but also relevant to the 21st-century learning paradigm.

The validation results also showed that the technology integration in the product received an excellent rating from the validators. This condition indicates that technology is not used merely as a medium for conveying information, but has become an integral part of the learning process. This is in line with the development of higher education, which positions technology as a means to build a more flexible, collaborative, and adaptive learning experience to student needs. The LMS integration in Edukit Smart Pedagogy allows students to access materials, learning videos, reflection instruments, and assessment tools in an integrated manner, allowing the learning process to take place both synchronously and asynchronously.

However, the validation process also yielded several recommendations for improvement, which are crucial for product refinement. The validators suggested simplifying the LMS interface, increasing the number of automotive learning case studies, and making the pedagogical reflection rubric more detailed to provide more specific feedback to students. This input demonstrates that validation serves not only as an assessment process but also as a mechanism for improving product quality through a continuous revision cycle.

Overall, the validation results indicate that the ASOKA-based Edukit Smart Pedagogy meets the criteria as a suitable learning tool for use in PPG learning. The high level of validity provides a strong foundation for further research into practicality and effectiveness testing. Therefore, product validity is not only an indicator of design quality but also a crucial prerequisite for successful implementation in subsequent learning stages.

Okay. I'll continue with the same standard: not just describing the results, but connecting them to theory and previous research, then concluding with an interpretation and contribution. I'll still use the references already included in your proposal.

3. Practicality of ASOKA-Based Smart Pedagogy Edukit in PPG Learning

Practicality is an important indicator in development research because it shows the extent to which a product can be used effectively by target users without experiencing significant obstacles. In this study, the results of the practicality test showed that the ASOKA-based Edukit Smart Pedagogy obtained a very practical category, both based on the assessment of lecturers and PPG students in the automotive study program. The high level of practicality indicates that the developed product not only has good conceptual quality, but is also easy to understand, easy to operate, and able to support the learning process optimally.

The research results showed that students had no difficulty following the learning flow, which was structured based on the syntax of "Analyze," "Convey," "Process," "Assess," and "Action." Each learning stage was equipped with clear instructions, digital media easily accessible through the Learning Management System (LMS), and worksheets that helped students develop learning tools step by step. This enabled students to focus more on the pedagogical thinking process than on the technical aspects of using the learning tools.

The lecturers also responded positively to the use of Edukit Smart Pedagogy. According to the lecturers, the implementation guide, assessment rubric, and reflection tools facilitated the learning facilitation process because all student activities were systematically structured. Lecturers no longer spent a significant amount of time explaining the procedures for developing learning tools, but instead acted more as facilitators, providing feedback on the quality of students' learning designs. This change in the lecturer's role is an indicator that learning is shifting toward a student-centered approach, as expected in the transformation of higher education.

The findings of this study are in line with the Experiential Learning theory developed byAY Kolb & Kolb (2022; Morris, (2020); Tondeur et al., (2020); and Valtonen et al., (2020)which emphasizes that the learning environment must be designed in such a way that students can experience the learning process themselves through structured activities. According toD.A. Kolb, (1981)Learning experiences will be more effective if students are given the opportunity to explore, reflect, conceptualize, and apply them repeatedly. In this study, the structure of Edukit Smart Pedagogy allows students to systematically navigate all these stages, making learning easier to understand and more meaningful.

The research results also support the studyMorris (2020)which states that the success of implementing Experiential Learning is greatly influenced by the quality of learning activity design. Activities designed sequentially will make it easier for students to build connections between learning experiences and the concepts being studied. In the ASOKA-based Edukit Smart Pedagogy, this connection is realized through the integration of automotive learning case studies, the development of learning tools, collaborative discussions, and pedagogical reflections conducted at the end of each learning cycle. Thus, students gain a more comprehensive learning experience compared to conventional learning, which generally only focuses on delivering material.

The product's practicality is also influenced by the integration of learning technology. Observations show that students can access all materials, learning videos, worksheets, and assessment instruments through the LMS without experiencing significant obstacles. This integration provides flexibility for students to learn synchronously or asynchronously according to their individual needs. This condition aligns with the opinion ofAgyeman (2024; and Gao (2025)which states that the use of systematically designed learning technology can improve the quality of learning interactions and expand students' opportunities to build knowledge independently.

In addition to supporting learning flexibility, LMS use also strengthens student reflection. Through assignment upload features, online discussions, and digital reflection sheets, students have the opportunity to document their competency development throughout the learning process. These documented reflections facilitate lecturers' ongoing feedback, making the learning process more adaptable to student needs.

The findings of this study also demonstrate that the high level of practicality is influenced by the product's suitability to the characteristics of vocational learning. The case studies used are derived from the real-life context of automotive learning in vocational high schools, making it easier for students to understand the problems teachers face in the field. The presence of these authentic examples strengthens the link between pedagogical theory and learning practice, so students no longer view the Understanding Students and Learning course as merely theoretical.

However, the evaluation results still revealed several aspects that needed improvement. Students suggested increasing the number of case studies to cover more automotive expertise, such as electric vehicles, electronic injection systems, and digital-based fault diagnosis. Furthermore, students hoped for an automated feedback feature in the LMS so they could identify deficiencies in the learning materials they had developed without having to wait for a lecturer's evaluation. This feedback demonstrates that product development still has room for further refinement in line with advances in learning technology.

Overall, the practicality test results demonstrate that the ASOKA-based Edukit Smart Pedagogy meets the key characteristics of research and development products: ease of use, understanding, and effective support for the learning process. This high level of practicality indicates that the product has significant potential for broader implementation in the Teacher Professional Program and other teacher education programs with similar learning characteristics.

Conclusion

The results of the study indicate that the needs analysis stage successfully identified the lack of integration of pedagogical competencies, vocational content mastery, and learning technology in the PPG learning process. Based on these findings, an ASOKA-based Edukit Smart Pedagogy was developed, consisting of an implementation guide, learning modules, automotive case studies, interactive digital media, TPACK strengthening instruments, pedagogical reflection sheets, and integration with the PPG Learning Management System (LMS). Expert validation results indicate that the product is in the very valid category in terms of content feasibility, learning design, media quality, TPACK integration, and learning support systems. The practicality test also received very positive responses from lecturers and students because it is easy to use, systematic, and supports both synchronous and asynchronous learning. Product implementation increases student engagement, pedagogical reflection skills, and the integration of pedagogical aspects, vocational content, and technology in the preparation of learning tools. In addition, the results of the effectiveness analysis indicate that the ASOKA-based Edukit Smart Pedagogy is more effective in improving TPACK competencies and the ability to design meaningful learning compared to conventional learning.

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