Validity of the PjBL-APCP Learning Model: Building a Teacherpreneur Mindset as an Action Plan to Solve Science Learning Problems for teacher candidate 21st Century

Ani Anjarwati[1*], Endang Susantini[2], Yuni Sri Rahayu[3]
[1,2,3]Universitas Negeri Surabaya/Doctoral Program of Science Education, Faculty of Mathematics and Natural Sciences

ani.18001@mhs.unesa.ac.id

ABSTRACT

To prepare graduates who are ready to compete and adapt to the demands of the 21st century, effective educational strategies must be implemented. Among the essential competencies for this era is the ability to create innovative solutions for emerging problems an ability closely associated with entrepreneurial thinking. Teachers who demonstrate entrepreneurial traits are often referred to as teacherpreneurs. The "Project-Based Learning with Action Plan as Core Project" (PjBL-APCP) model was designed to cultivate this mindset among future educators. This study focuses on validating the PjBL-APCP model using a developmental research approach, specifically a validation study. The validation process assessed two key dimensions: (1) content validity, also known as relevance, and (2) construct validity, which refers to internal consistency. The validation was conducted with input from three experts in science education, utilizing structured validation sheets. Findings from the research and analysis indicate that the PjBL-APCP model demonstrates strong alignment and coherence, supported by very valid and reliable results (agreement rate ≥ 75%). The model is structured into seven sequential stages: (1) Identifying Potential, (2) Stimulating Instinct, (3) Concept Development, (4) Strategic Management, (5) Cultivating Sharing and Compassion, (6) Sustainability, and (7) Collaborative Engagement. Supporting tools used during the implementation process such as the Semester Learning Plan (RPS) and Student Activity Sheets (LAM 01 to LAM 04) were also verified as valid and reliable. Overall, the PjBL-APCP model shows promise in fostering teacherpreneurship by equipping prospective science teachers with actionable strategies to address 21st-century educational challenges.

Keywords: PjBL-APCP, Validity, Teacherpreneur, Action Plan, Science Learning,

INTRODUCTION

The emergence of the Fourth Industrial Revolution necessitates significant advancements in human resource capacity (Ariyani & Zuhaery, 2021). The expectations brought by this revolution align closely with 21st-century competencies, where individuals are expected to demonstrate critical thinking, creativity, innovation, effective communication, and teamwork to successfully navigate contemporary global challenges (Stehle & Peters-Burton, 2019; Larson & Miller, 2011; González-Pérez & Ramírez-Montoya, 2022). In light of this, governments are called upon to devise comprehensive strategies to address globalization and build human resources that meet modern-day standards.

According to Sudrajat (2024), prioritizing the enhancement of human resource quality is a key agenda, as reflected in the fourth national goal, Asta Cita 4, which focuses on "advancing human resource development, science, technology, education, healthcare, athletic achievement, gender equity, and empowerment of women, youth, and individuals with disabilities." This emphasis on human capital is interconnected with Asta Cita 3, which seeks to "promote decent employment opportunities, foster entrepreneurship, nurture the creative economy, and sustain infrastructure progress."

The world of education also has a contribution to realizing the government's mission or ideal. For the development of human resources and entrepreneurship in the field of education, every educational institution should implement entrepreneurship education, one way is by instilling entrepreneurial values in students as a provision for the necessary life skills (Boldureanu, et al., 2020). Universities are higher education institutions that produce quality human resources, one of which is teachers. Teachers with an entrepreneurial spirit are named teacherpreneurs (Berry, 2010; Yeleussov, 2022). Entrepreneurial values and behaviors can help students have competitiveness in the 21st century (Ariyani & Zuhaery, 2021). One of the characteristics of entrepreneurship is the ability to innovate. Yoganandham (2025) mFostering innovation is very important because it prepares students to face complex challenges, create new solutions, and contribute to progress in various fields, one of which is education.

Ariyani & Zuhaery (2021) teachers' innovative skills and creativity in Indonesia are still substandard. Yoganandham (2025) The current education system often emphasizes learning by rote and theoretical knowledge rather than practical and innovative problem-solving. Training teachers to have skills in innovation can start by preparing prospective teacher students from the moment they pursue higher education.

A teacherpreneur is always following the development of new knowledge and skills according to his field of expertise, willing to work or think hard (inventive thinking) in following changes; and produced many creative and innovative works (Arruti & Castro, 2020). In order for prospective teacher students to be able to carry out the function of

teacherpreneur while working, in lectures students are involved in activities that represent the character of the teacherpreneur, namely innovation activities. Learning in innovation programs can be carried out with the involvement of students in the completion of project ideas, according to the learning problems to be solved, who the target audience is, and what the innovative dimensions are (Oliveira & Cardoso, 2021).

One of the innovative learning models that can improve 21st century skills is project-based learning (Dewi & Arifin, 2024). Judijanto (2025) Project-Based Learning (PjBL) places real projects as the center of the learning process. Doyan, et al., (2025) PjBL can also be applied to improve students' scientific attitudes and has high urgency because of its potential to provide various benefits for 21st century education. In PjBL, students are given the opportunity to plan, implement, and complete a project that is relevant to their curriculum.

A challenging project that is suitable for prospective teacher students is the development of learning Action Plans (AP) in order to solve problems in learning (Hugh, 2019). AP is a plan that contains focused and directed actions so that learning goals are realized (Plan, 2022). so the AP development project in the preparation of prospective teachers with teacherpreneur character is the development of AP in order to solve *actual problems*. Actual problems about learning science in schools.

The researcher has conducted preliminary studies to identify the character of teacherpreneurs on the results of innovative works in learning in teachers who graduated from the PGSD FKIP UPM Study Program and teachers who graduated from other campuses as many as 80 elementary school teachers (40 UPM alumni and 40 non-UPM alumni) obtained the following findings: (1) none of the target teachers had real work in the six groups of innovative works and (2) only three of the six groups of innovative works (50%) were detected to have The target teacher but not detected has tangible evidence of innovative work that represents the character of the teacherpreneur.

Initial observations reveal that teacherpreneurship is still rare at the elementary education level, with only a few educators demonstrating teacherpreneurial traits. This highlights the need for in-depth studies and research efforts aimed at integrating a project-based learning framework with an Action Plan (AP). The instructional approach designed for this purpose is called Project-Based Learning with Action Plan as the Core Project (PjBL-APCP). Insights gathered from these preliminary findings play a crucial role in shaping the model's design. The viability of the PjBL-APCP model is evaluated based on three key criteria: validity, practicality, and effectiveness (Ploom & Nieveen, 2010).

This study seeks to assess the validity of the developed PjBL-APCP instructional model. The validation process encompasses both content validity (relevance) and construct validity (consistency). Relevance pertains to how accurately the model aligns with learning goals, theoretical foundations, implementation strategies, and the educational context.

Consistency, on the other hand, examines the extent to which the learning stages are operationalized in accordance with the model's structured syntax.

METHOD

The research methodology used is educational research design. The design of the development of the PJBL-APCP model that has been developed follows the ADDIE stage (Brach, 2009) with the following explanation: Analysis Stage. Analysis of research findings on problems to be solved from the juridical, theoretical, and empirical dimensions. The analysis carried out includes (1) the framework for the development of the learning model and (2) a description of the learning model developed and evaluated to be continued at the next stage. Design Stage, Design; (1) hypothetical model *of PjBL-APCP* (2) operational steps for the implementation *of PjBL-APCP* (3) learning tools to support the implementation of PjBL-APCP (4) data collection instruments, and evaluations are carried out to be continued in the next stage. Development Stage: (1) PjBL-APCP Model Book, (2) Focus Group Discussion (FGD) to equalize the perception of the development of *the PjBL-APCP* model, (3) validation sheet for *the PjBL-APCP learning model* and its supporting devices. It is evaluated and declared valid constructively and the content can be continued at the next stage. Implementation Stage, (1) pilot implementation (limited trial) to 20 PGSD S1 Study Program students who are attending the lecture "Science Learning in Elementary School". This stage generates preliminary data on the practicality and effectiveness of the *PjBL-APCP Model*. An evaluation is carried out on what needs to be increased in intensity, the model is declared constructively valid and the content can be continued at the next stage. (2) final Implementation, *(*extensive trial*)* to 88 PGSD S1 Study Program students who are attending the lecture "Science Learning in Elementary School". In the *Evaluation* Stage, *the PjBL-APCP* Model that has been extensively tested is then evaluated to produce final data on the practicality and effectiveness of the *PjBL-APCP model*. This stage ended with the development of conclusions about the feasibility of *the PjBL-APCP model* which was developed to equip prospective elementary school teachers with innovation competencies as teacherpreneur characters.

The PjBL-APCP instructional model and its associated learning instruments were reviewed and validated by a panel of three experts specializing in science education. These validators included two professors—one from the State University of Surabaya (UNESA) and one from Nahdlatul Ulama University Surabaya (UNUSA)—and one doctoral-level academic from UNESA. The content validation process covered multiple elements,

including: (1) how clearly the need for the model was explained, (2) its alignment with current knowledge advancements, (3) clarity in theoretical and empirical foundations, (4) structure and execution of the model, and (5) how the learning environment is managed (Arends, 2012; Simamora et al., 2022; Sutoyo et al., 2023; Nieveen & Plomp, 2013; Joyce, Weil & Calhoun, 2009).

Construct validation, on the other hand, evaluated several dimensions: (1) internal consistency of the model, (2) coherence between theory, empirical backing, and the learning phases, (3) alignment between model design and its classroom implementation, (4) organization of the learning environment, and (5) effectiveness of assessment strategies (Joyce, Weil & Calhoun, 2009; Arends, 2012; Nieveen & Plomp, 2013).

Data from both content (relevance) and construct (consistency) validations were analyzed through qualitative statistical methods. This evaluation aimed to derive a judgment regarding the soundness of the proposed model and the reliability of the assessments. Each validation component was rated using a four-point scale, and the final analysis was based on the average scores from all three validators. These numerical results were then translated into qualitative interpretations using a four-tier criteria system shown in Table 1.

FINDINGS AND DISCUSSION

1. Findings

Table 1: Criteria for the Validity of the *PjBL-APCP* Learning Model

Score intervals	Criteria	Description
$3.25 < P \leq 4.00$	Very valid	It can be utilized without any need for modification
$2.50 < P \leq 3.25$	Valid	Can be utilized with slight modifications
$1.75 < P \leq 2.50$	quite valid	It is compatible with different versions
$1.00 < P \leq 1.75$	Invalid	It is inoperable and necessitates consultation

References: Modified from Tukiran, Suyatno & Hidayati (2017); Handayani, Rahayu & Agustini (2020)

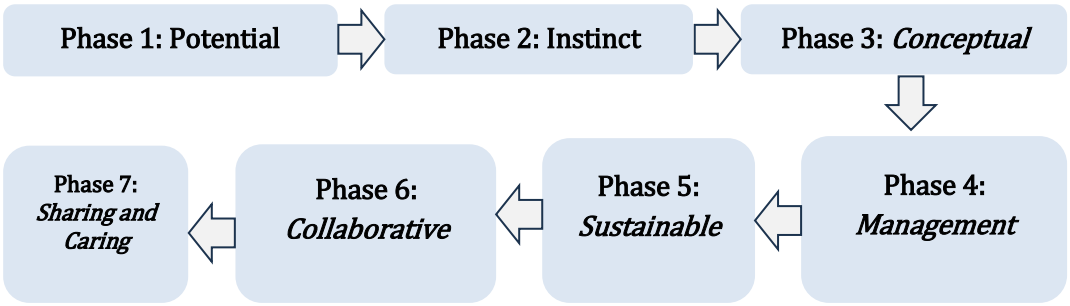
The reliability of the validation instruments and supporting components for the PjBL-APCP instructional model is assessed through inter-rater agreement analysis. This involves computing the agreement percentage (R) among reviewers, following the statistical method proposed by Borich (1994). According to Borich, these tools and validation

instruments are considered dependable when the agreement rate reaches or exceeds 75%.

Instructional models are typically categorized according to the intended learning outcomes, the procedural steps (syntax), and the instructional environment. Learning outcomes refer to the goals that students are expected to achieve, while the syntax outlines the sequence of phases within the instructional process. The learning environment includes the settings and conditions where the instruction occurs and plays a key role in enhancing learners' motivation and self-regulation (Arends, 2012). According to Joyce et al. (2009), five fundamental components define an effective learning model: (1) instructional steps or syntax, (2) social interaction framework, (3) guiding response strategies, (4) available resources and support systems, and (5) the primary and secondary effects of teaching.

The PjBL-APCP framework comprises seven core stages: (1) Identifying Potential, (2) Awakening Instinct, (3) Building Concepts, (4) Organizing Management, (5) Ensuring Sustainability, (6) Promoting Collaboration, and (7) Encouraging Sharing and Caring. Each stage includes specific performance indicators. A detailed illustration of these steps can be found in Figure 1.

Figure 1: PjBL-APCP Model Syntax



The structure of the PjBL-APCP model is illustrated through specific learning activities at each phase, each of which is paired with performance indicators that reflect the learning objectives intended to be achieved at that stage. These instructional activities are purposefully aligned with the targeted goals of each phase. At every point in the learning process, indicators linked to the development of students' innovation skills—particularly in preparing them to become teacherpreneurs—are integrated and elaborated in Table 2.

To be considered valid, the learning model produced through development research must fulfill both relevance and consistency criteria. The validation process involves examining the content and construct

validity of the model prototype. Content validity refers to whether the model addresses educational needs and is grounded in up-to-date scientific insights. Meanwhile, construct validity focuses on how systematically and logically the instructional model has been formulated (Plomp & Nieveen, 2013). The validation team comprises three professionals with expertise in science education. These experts use a set of instruments—one for validating the model framework and another for the associated instructional tools—to evaluate the developed model. The outcomes of both the content and construct validation, as well as the reliability assessment of the PjBL-APCP model, are presented in Table 3.

Table 3: Results of Content Validation, Construct Validation and Reliability

No	Component	Avarage	Validity category	Reliability value	Reliability category
A. Content validity of PjBL-APCP model					
1	Clarity of the background of the model requirements	3.65	Very valid	100	reliable
2	State of the art of knowledge	3. 84	Very valid	96.77	reliable
3	Clarity of theoretical and empirical	3.87	Very valid	93.33	reliable
4	Planning and implementation of models	3. 82	Very valid	98.42	reliable
5	Management of the learning environment	3. 82	Very valid	93.33	reliable
B. Construct Validity of PjBL-APCP model					
1	Learning model consistency	3.86	Very valid	96.77	reliable
2	Consistency of theoretical and empirical support for the implementation of the syntax	3.91	Very valid	96.80	reliable
3	Planning, consistency and model implementation	3,86	Very valid	96.70	reliable
4	Consistency in the management of the learning environment	4.00	Very valid	100	reliable
5	Assessment and evaluation avarage	3.81	Very valid	96. 40	reliable

Instructional materials were also created to facilitate the application of the PjBL-APCP model, which emphasizes fostering students' innovative capabilities as a foundation for developing teacherpreneurial traits. The content and construct validity of these instructional tools assess how logically and consistently the supporting components of the learning model have been designed. The validated materials include the Semester Learning Plan (RPS) and four Student Activity Sheets (LAM) labeled 01 through 04. A team of three expert reviewers evaluated both the PjBL-APCP model and its associated learning tools using a standardized validation rubric provided by the researchers. The results of this validation process for the PjBL-APCP instructional tools are summarized in Table 4.

Table 4: The Results of the PjBL-APCP Model Learning Tools Validation

No	Component	Average	Validity category	Reliability Value	Reliability Category
1	Semester Learning Plan (RPS)	3.89	Very valid	98.64	reliable
2	LAM 01: Teacherpreneur Innovation Competency	3.81	Very valid	98.61	reliable
3	LAM 02: Action Plan (AP)	3.91	Very valid	99.14	reliable
4	LAM 03: PjBL-APCP	3.70	Very valid	95.89	reliable
5	LAM 04: guidelines for recording FGDs aims to gather information on the action plan (*Action Plan/AP*	3.73	Very valid	93.79	reliable

2. Discussion

The evaluation of the PjBL-APCP learning model, carried out by three experts specializing in science education, revealed that both its content and construct validity fall within the "highly valid and reliable" category. The model is composed of several core components, including its instructional phases (syntax), the social system in which learning occurs, guiding response principles, supporting resources, and both direct and indirect instructional outcomes (Joyce et al., 2009; Utomo, 2020). The instructional framework incorporates seven structured phases: (1) Potential, (2) Instinct, (3) Conceptual, (4) Management, (5) Sustainable, (6) Collaborative, and (7) Sharing and Caring, each with specific performance indicators. The interaction patterns between lecturers and students described in the RPS demonstrate the model's social structure and

principles of interaction. The tools and materials outlined in the RPS serve as part of the model's support system. Instructional and affective impacts are tracked using indicators aimed at cultivating teacherpreneurial competencies in learners.

The logical structure and rationality of the PjBL-APCP model satisfy model consistency standards. This is reinforced by validation outcomes confirming the quality of its components, all of which align with established instructional criteria. The model reflects both theoretical coherence and practical rationale, grounded in empirical evidence and a solid conceptual foundation. It integrates key aspects such as learner activities, the instructional setting, evaluation tools, and assessment methods (Arends, 2012).

Following a Focus Group Discussion, the model's book content and construct were validated by three subject matter experts. The assessment of the PjBL-APCP model was based on three dimensions: (1) the necessity for developing the model, (2) its foundation in cutting-edge educational theory, and (3) a clear and structured description of the model (Plomp & Nieveen, 2013). Results of this analysis—detailed in Table 3—showed an average validity score of 3.85, placing it in the "very valid" category, and a reliability rating of 94.44% (PA $\geq$ 75%), confirming its robustness. The model meets the standards for relevance, addressing a clear educational need, being grounded in innovative theory, and providing clear implementation guidance.

The design of the PjBL-APCP model draws on both theoretical frameworks and empirical research. Its theoretical underpinnings include Co-Creation Theory (Bovill), Information Processing Theory (Slavin, 2009), Dual Coding Theory (Paivio in Slavin, 2009), and Self-Reliance Theory focusing on independence and risk-taking (Chaplin, 2011), supported by other scholars (Leong & Bodrova, 2012; Miller, 2011; Moreno, 2010; Schunk et al., 2014; Woolfolk, 2016).

This model evolved from a blend of Project-Based Learning (PjBL) and Action Plan frameworks, building upon prior empirical research. Various adaptations of PjBL exist, tailored to different competency development objectives. The syntax adopted in this model is inspired by Fleming (2000), which includes: (1) defining the project focus, (2) identifying critical knowledge and skills to be learned, (3) launching the project and engaging learners, (4) facilitating discussions and providing guidance, (5) setting timelines and project checkpoints, (6) supervising project execution, and (7) conducting evaluations and (8) planning future steps.

The data presented in Table 3 confirm the model's high validity and reliability. Experts proposed several refinements for the model's theoretical and empirical analysis, recommending more detailed exploration of previous models' limitations to strengthen the rationale for the new model's development. Incorporating this feedback, the PjBL-APCP model was enhanced to better foster teacherpreneurial competencies among students.

To ensure successful implementation of the model, instructional tools were also developed and subsequently validated. As shown in Table 4, these included the Semester Learning Plan (RPS) and several Student Activity Sheets (LAM), all of which were found to be valid and dependable. Reviewers advised refining the RPS by elaborating on learning activities and aligning them more clearly with goals related to nurturing teacherpreneurial traits. Regarding lecture program design, suggestions were made to better align course learning outcomes with overall graduate attributes and indicators.

Experts evaluating the LAM emphasized that its design should clearly reflect the unique traits of the PjBL-APCP model. They recommended enhancing the content's visual appeal to boost student engagement and comprehension. Additionally, each task or section in the LAM should include clear instructions and explanations. Based on this feedback, the instructional tools were revised to better reflect these pedagogical principles. When properly designed, such tools can effectively facilitate the integration of educational frameworks into practice (Berndtsson et al., 2020; Mavilidi et al., 2021; Oliveira et al., 2019; Reusser, 2012).

CONCLUSION

Drawing upon the findings and analysis of the research, it can be inferred that the PjBL-APCP instructional model demonstrates a high level of relevance and internal consistency, meeting the standards of strong validity and reliability (agreement percentage $\geq 75\%$). The structure of the developed PjBL-APCP model includes seven distinct phases: (1) Identifying Potential, (2) Awakening Instinct, (3) Building Conceptual Understanding, (4) Managing Implementation, (5) Ensuring Continuity, (6) Fostering Collaboration, and (7) Promoting Sharing and Empathy. Validation outcomes of the supporting instructional tools—such as the Semester Learning Plan (RPS) and Student Activity Sheets (LAM) 01 through 04—confirm their validity and reliability. This model holds promise for cultivating the teacherpreneur mindset in teacher candidates. Nevertheless, further studies are necessary to assess its overall effectiveness and practical

application in nurturing teacherpreneur competencies among pre-service educators.

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