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Validity Of Project Based Learning Model Integrated Sasambo Local Wisdom To Improve Students' Entrepreneurial Science Thinking

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ABSTRACT

This study aims to develop a project based learning model integrated with Sasambo local wisdom to enhance entrepreneurial science thinking. The type of research conducted is developmental research. The subject of development research is the Sasambo integrated Project Based Learning (PjBL) model and its supporting devices, applied to students. The data collection method involved validating the model book and supporting instructional materials for model implementation. The validation was carried out by three science education experts who evaluated the model book, semester learning plans, lecture session plan, student activity sheets, and the assessment sheets for entrepreneurial science thinking. The research findings indicate that the project based learning model integrated with Sasambo local wisdom shows excellent relevance and consistency, with criteria that are highly valid and reliable. The project based learning model integrated with Sasambo local wisdom consists of six stages: (1) project orientation, (2) problem identification within groups, (3) information gathering, (4) project design, (5) project implementation, and (6) presentation and evaluation. The developed model can effectively train entrepreneurial science thinking, as the learning stages are already integrated with the indicators of entrepreneurial science thinking.

INTRODUCTION

In recent years many countries have faced issues of unemployment and a lack of job opportunities for their citizens. Unemployment has forced many nations to find ways to enable their citizens to become entrepreneurs. In this context, the concept of entrepreneurship and entrepreneurial education has now emerged in the educational curricula of several countries (Chang et al., 2024). It is crucial for students to possess entrepreneurial characteristics. Science education is one of the subjects that can be utilized to develop entrepreneurial character (Syukri et al., 2013). Entrepreneurial character education through science lessons can be implemented in the curriculum using a project-based learning (PjBL) approach that integrates entrepreneurial concepts (Zulfikar, 2024) such as product innovation, environmentally friendly technology, and the utilization of natural resources. These projects train students to think critically, creatively, and solution-oriented, while also understanding the fundamentals of sustainable business management(Wibowo et al., 2024). By instilling entrepreneurial character, students can change their perspective, understanding that after graduating from college, they do not need to be confused about finding a job but instead can take the initiative and innovate to create job opportunities for themselves and others (Sulistyowati & Salwa, 2016). Current education in Science, Technology, and Mathematics (STM) has not yet achieved its goal of producing independent graduates. If entrepreneurial

education is introduced within STM education, it will produce graduates with an entrepreneurial spirit, enabling them to establish independent businesses. A concrete example of implementing Science, Technology, and Mathematics (STM) integrated with entrepreneurship is having students create a simple Internet of Things (IoT) product, such as an automatic temperature regulator for greenhouses, which can be developed into a smart farming device business. In science, students can design bioplastic products from organic waste, reducing plastic waste while providing environmentally friendly solutions. Non-business program students often have very interesting ideas but lack training in sales and marketing. These students may need courses on intellectual property, sales, and marketing. In fact, most students from non-business faculties tend to be product-oriented in their business approach and do not understand that it is crucial to consider how innovative products are needed by the market. This will help avoid the mistakes made by most young entrepreneurs who develop a product for the first time after recognizing market potential (Martin & Iucu, 2014).

The low entrepreneurial capability among university graduates in West Nusa Tenggara (NTB) may stem from the limited integration of entrepreneurship into academic course curricula. Based on a local survey conducted in NTB, only a few university programs explicitly include entrepreneurship courses or practical business training. Most courses remain theoretical, lacking an emphasis on entrepreneurial applications relevant to regional needs. This is concerning given NTB's local potential in sectors such as tourism, traditional weaving crafts, and agriculture, which require graduates capable of leveraging local resources to create independent business opportunities. Data from the NTB Statistics Agency indicates that the educated unemployment rate among university graduates reached 29.07% in 2022 (Wulandari et al., 2023), partly due to a lack of practical skills and an entrepreneurial mindset. This highlights the need for a more innovative curriculum, such as integrating entrepreneurship into project based learning tailored to local potentials. By incorporating entrepreneurship courses combined with technology, science, or the creative economy, students can be equipped with the skills not only to seek employment but also to generate new job opportunities (Hameed & Irfan, 2019; Pardo-Garcia & Barac, 2020). Such an initiative would address unemployment while simultaneously supporting regional economic growth.

The West Nusa Tenggara region is composed of the Sasak, Samawa, and Mbojo (Sasambo) tribes, which are the three major ethnic groups inhabiting the islands of Lombok and Sumbawa. The majority of the Sasak people reside on Lombok Island, while the Samawa and Mbojo communities predominantly inhabit Sumbawa Island. The Samawa people primarily live in the western part of Sumbawa Island, whereas the Mbojo people are more concentrated in the eastern part of Sumbawa Island (Darling-Hammond et al., 2020). Administratively, the Sasak people mostly reside across all regencies and cities on Lombok Island, which consists of four regencies and one city. Meanwhile, the Samawa tribe is largely found in two administrative regions: Sumbawa Regency and West Sumbawa Regency. The Mbojo tribe, located in the eastern part of Sumbawa Island, resides in three administrative regions: Dompu Regency, Bima Regency, and Bima City (Bahri, 2019). The youth of NTB must actively engage in the process of entrepreneurial development, considering their role as the future generation of the nation. However, the NTB Provincial Government's 1000 Young Entrepreneurs program has not been effectively implemented due to the relatively low entrepreneurial spirit among NTB youth. Given the low entrepreneurial spirit among students, it is essential to develop their entrepreneurial mindset through project-based learning.

Project Based Learning (PjBL) originated from the progressive education movement, which emphasizes more learner-centered approaches and experiential education to support "deeper learning" through the active exploration of real-world problems and challenges. PjBL is defined as a learning model with five core criteria: project focus, driving questions, inquiry

construction, project autonomy, and realism in projects. Several studies have examined the effectiveness of PjBL in supporting the three domains of student learning identified by the National Research Council (NRC): cognitive, intrapersonal, and interpersonal. Quantitative studies have shown a strong correlation between PjBL and cognitive skills (Harris et al., 2014). Many aspects of the PjBL model are designed to support the development of intrapersonal and interpersonal competencies, such as communication and collaboration skills, metacognitive skills, and self-regulation skills. Intrapersonal and interpersonal competencies can be enhanced through the PjBL model. Based on a literature review on project based learning research (Condliffe, 2017), it is recommended that further studies be conducted to confirm the model's effectiveness in preparing students for higher education and career readiness. Additionally, there is a need for studies to measure the outcomes of the learning process and the final products resulting from the use of the PjBL model in education (Rehman et al., 2024).

Based on studies regarding the effectiveness of PjBL, the focus has predominantly been on cognitive, intrapersonal, and interpersonal aspects, while career-related aspects, as recommended by Condliffe's review, have not been reported or followed up on. Career and life skills are part of the 21st-century skills set, which includes aspects such as flexibility and adaptability, initiative and self-awareness, social and cross-cultural interaction, productivity and accountability, and leadership and responsibility. All these aspects of career and life skills are related to entrepreneurial science thinking (Koerniawati & Sintawati, 2024). Therefore, an in-depth study is needed to integrate the PjBL model with an Entrepreneurial Science Thinking approach, which emphasizes product based learning outcomes.

Integrating Sasambo local wisdom with the Project based Learning (PjBL) model represents a strategic innovation in building education rooted in cultural values and entrepreneurship. Sasambo local wisdom, encompassing the traditions, arts, and life practices of the West Nusa Tenggara community, provides a relevant and authentic learning context. Through PjBL, students not only study theories but also engage directly in projects that foster critical thinking, collaboration, and creativity (Zulyusri et al., 2023). This approach enables students to develop products or solutions based on local wisdom, such as innovations in traditional weaving, eco-tourism, or distinctive culinary practices, which can contribute to regional economic development. It trains them to integrate scientific thinking with cultural values, making learning more meaningful while preserving local heritage (Lasmana et al., 2024).An instrument for measuring entrepreneurial science thinking has been developed (Ahmad & Siew, 2022), based on the Entrepreneurial Science Thinking Model (ESTM), which consists of five constructs: observation, new ideas, innovation, creativity, and value.

Given this situation, efforts are needed to enhance entrepreneurial science thinking skills through the use of an effective learning model. The developed learning model must be able to foster entrepreneurial science thinking by considering the following aspects: (1) Activities that involve observing and reflecting on products, (2) Activities that involve designing project plans with consideration for the uniqueness of the design ideas for the resulting learning products, (3) Activities for refining and finalizing product ideas based on elaboration results, and (4) Testing products to ensure that the scientific learning ideas or products have economic value (Ibrahim & Rashid, 2022). These activities will be developed into a new learning model that can enhance students' entrepreneurial science thinking skills. One way to enhance entrepreneurial science thinking is by developing a comprehensive learning model, specifically a Project Based Learning model integrated with Sasambo local wisdom.

METHODS

Research Design

The type of research employed is educational design research. This type of research aims to develop specific educational products and evaluate their effectiveness. Educational design research is a method used to design, develop, and evaluate an intervention applied to address complex problems in the field of education, with the goal of achieving satisfactory results that meet the needs of the intervention (Plomp, 2014). Interventions can take the form of educational products, teaching processes, professional development programs, or educational policies. The research design in education begins with the identification of significant problems that require innovative solutions based on scientific inquiry, leading to the development of an intervention.

Research Target

The subjects of the development research are the Sasambo integrated Project Based Learning (PjBL) model and its supporting tools, applied to students of the Primary School Teacher Education program who are enrolled in the Elementary Science Concepts course. The developed learning model and its supporting tools were validated by three experts in the field of science education: two doctor from Muhammadiyah University of Mataram and one professor from the University of Mataram. The expert purposive sampling technique is used when researchers need to obtain knowledge from individuals with specific expertise (Oribhabor & Anyanwu, 2019). This method involves intentionally selecting participants who possess the requisite skills, knowledge, or experience relevant to the study's objectives, ensuring the data collected is highly specialized and insightful.

Research Data

The technique used for data collection in this research is validation through questionnaires. Validation is employed to assess the content and construct validity of the model. Content validity is used to determine whether the developed model aligns with the needs of the model's development and whether its design is based on the latest knowledge. Construct validity is used to obtain data on the consistency of the developed model. The learning model and its supporting tools are validated by experts. The validation results are used as guidance to refine the developed model and learning tools.

Research Instruments

The instrument used in this research to address the research question regarding the feasibility of the developed model is the validation questionnaire. The validation questionnaire for the learning model is designed to assess both content validity and construct validity of the model. The validation sheet for the model's tools aims to evaluate the feasibility of the developed learning tools, which include: the Semester Learning Plan, Course Unit Plan, Student Worksheets, and Assessment Sheets.

Data Analysis

The validity analysis of the model and supporting tools for the Sasambo integrated Project Based Learning model was conducted using qualitative descriptive techniques. The validation scores provided by the validators were grouped into four categories: (1) not valid, (2) less valid, (3) valid, and (4) very valid. The final validation score for each aspect was determined based on the average score from the validators. The reliability of the validation instrument for the Sasambo-integrated project based learning model and its supporting tools was calculated using the interobserver agreement method, specifically through statistical analysis of the percentage of agreement (R). The validation instrument is considered reliable

if it achieves a percentage score of ≥ 75% (Hikmawati et al., 2020). The analysis of the validity and consistency of the PBL model shows that this method is effective in fostering entrepreneurial thinking through project-based learning that encourages innovation and practical solutions. The PBL model is proven valid as it integrates entrepreneurial concepts with real-world contexts, such as the development of market-driven products. Its consistency lies in the systematic process, training students to think critically, creatively, and collaboratively to produce competitive products or ideas.

RESULTS AND DISCUSSION

A learning model can be categorized based on three main aspects: learning objectives, model syntax, and the learning environment. Learning objectives are the desired outcomes of the learning process, aligned with the predetermined planning. The syntax of the learning model refers to the stages or steps undertaken during the learning process. The learning environment is the context in which learning takes place, encompassing factors that can influence the learning process, such as methods for motivating and conditioning students. The learning environment also involves physical, social, and psychological aspects that support the effective achievement of learning objectives. There are five key components in a well-designed learning model: (1) syntax, (2) social system, (3) reaction principles, (4) support system, and (5) instructional and nurturant effects (Capel & Whitehead, 2015).

The hypothetical model of the Project Based Learning integrated with Sasambo local wisdom to enhance students' entrepreneurial scientific thinking consists of six phases: (1) Project Orientation, (2) Problem Identification within Groups, (3) Information Gathering, (4) Project Design, (5) Project Implementation, and (6) Presentation and Evaluation. The explanation for each syntax is as follows.

1. Project Orientation

Students are introduced to the concept of Project-Based Learning (PBL) and the significance of Sasambo local wisdom. The instructor explains the learning objectives, project structure, and how local wisdom can be applied in the contexts of science and entrepreneurship. This phase can train observation skills in the indicators of entrepreneurial science thinking.

2. Problem Identification within Groups

Students are divided into small groups. Each group is tasked with identifying a problem or opportunity relevant to Sasambo local wisdom. The instructor assists in formulating specific and challenging project problems. This activity can foster the "new idea" indicator.

3. Information Gathering

Each group conducts research to gather information about Sasambo local wisdom related to their project. This activity includes literature review, interviews, and surveys. Students are encouraged to delve deeper into cultural values and local potentials that can be integrated into their projects. This activity can develop the "new idea" indicator.

4. Project Design

Based on the research conducted, the groups design solutions or products that integrate local wisdom with principles of science and entrepreneurship. Students create a project plan that includes objectives, methods, required materials, and a timeline for implementation. This phase trains the "new ideas" and "innovation" indicators.

5. Project Implementation

Groups begin to implement their project plans in class. They conduct experiments, develop prototypes, or carry out simulations according to the prepared plan. The instructor provides guidance and support throughout this process, ensuring that each step aligns with the learning objectives. This stage develops the "creativity" indicator.

6. Presentation and Evaluation

Each group presents their project outcomes to the class. The presentation includes an explanation of the process, results, and how Sasambo local wisdom was integrated into the project. Evaluation is conducted by the instructor and classmates based on established criteria, including creativity, scientific understanding, and entrepreneurial aspects. Following the presentations, a reflection session is held to identify lessons learned and improvements for future projects. Through this activity, the "value" indicator can be developed.

Learning activities in each phase are accompanied by indicators of achieving entrepreneurial scientific thinking, which will be developed at each stage of the Project Based Learning model integrated with Sasambo local wisdom, as shown in Table 1.

Table 1. Relationship between Syntax, Learning Activities, and Entrepreneurial Science Thinking Indicators

Syntax	Learning Activities	Entrepreneurial Science Thinking Indicators
Phase 1. Project Orientation,	1. The instructor explains the concept of Project-Based Learning (PjBL) and the importance of Sasambo local wisdom. 2. Students are introduced to the project goals, expected outcomes, and assessment criteria. 3. A class discussion is held on examples of Sasambo local wisdom and how it can be applied in science and entrepreneurship. 4. The instructor presents videos or case studies of successful projects that utilize PjBL and local wisdom	Observation
Phase 2. Problem Identification within Groups,	5. Students are divided into small groups consisting of 3-5 members. 6. Each group discusses potential problems or opportunities that can be addressed by leveraging Sasambo local wisdom. 7. Groups write down and present the identified problems to the class for feedback and suggestions. 8. The instructor assists each group in refining the problem to be solved and suggests resources that can be utilized.	• New Ideas • Innovation
Phase 3. Information Gathering, and Evaluation	9. Groups conduct literature research, interviews with community leaders, and field surveys to gather relevant information. 10. Students collect data on Sasambo local wisdom related to the identified problems, including traditional techniques, local materials, and cultural practices. 11. Each group creates research notes and organizes the collected data into a preliminary report. 12. A class discussion is held to share initial findings and receive feedback from the instructor and classmates.	• Observation • New Ideas
Phase 4. Project Design,	13. Based on the collected information, each group designs solutions or products that integrate local wisdom with science and entrepreneurship. 14. Groups create a project plan that includes objectives, methods, required materials, implementation schedule, and task distribution. 15. The instructor provides feedback and guidance to ensure that the project plan is realistic and aligned with the learning objectives. 16. Groups prepare a project proposal and present it for approval from the instructor.	• New Ideas • Innovation
Phase 5. Project Implementation,	17. Groups begin implementing their project plans, conducting experiments, prototypes, or simulations according to the plan.	Creativity

Syntax	Learning Activities	Entrepreneurial Science Thinking Indicators
	18. Students carry out observations, record results, and make adjustments as needed. 19. The instructor provides guidance, technical support, and motivation throughout the implementation process. 20. Groups document the process and results of the project in the form of a final report.	
Phase 6. Presentation and Evaluation	21. Each group presents their project results to the class, using presentation media such as slides, videos, or posters. 22. The presentation includes an explanation of the process, results, and how Sasambo local wisdom was integrated into the project. 23. The class and instructor conduct an evaluation based on established criteria, including creativity, scientific understanding, and entrepreneurial aspects. 24. After the presentation, a reflection session is held where students provide feedback to each other and discuss lessons learned, along with suggestions for future improvements.	• New Ideas • Innovation • Value

The validator assesses the developed model using a model validation instrument with several assessment aspects. The results of content validation and construct validation of the Project Based Learning model integrated with Sasambo local wisdom are shown in Table 2.

Table 2. Results of Content Validation, Construct Validation, and Reliability

No	Component	Average	validity category	reliability value	reliability category
	A. Conten validity of project based learning model integrated with sasambo local wisdom				
1	Clarity of the background on the need for the model	3.87	very valid	100.00	reliabel
2	State-of-the-art knowledge	3.82	very valid	94.53	reliabel
3	Clarity of theoretical and empirical support	4.00	very valid	96.77	reliabel
4	Planning and implementation of the model	3.92	very valid	98.42	reliabel
5	Management of the learning environment	3.93	very valid	93.47	reliabel
	B. Construct Validity of project based learning model integrated with sasambo local wisdom				
1	Consistency of the learning model	3.86	very valid	95.69	reliabel
2	Consistency of theoretical and empirical support for the implementation of syntax	4.00	very valid	100.00	reliabel
3	Consistency in the planning and implementation of the model	3.93	very valid	96.77	reliabel
4	Consistency in the management of the learning environment	4.00	very valid	100.00	reliabel
5	Assessment and evaluation	3.83	very valid	96.77	reliabel

To support the implementation of the Project Based Learning model integrated with local wisdom of Sasambo, a learning tool was also developed that is oriented towards the development of creative thinking skills and science entrepreneurial thinking. The validation results of the learning tool for the Project Based Learning model integrated with local wisdom of Sasambo are presented in Table 3.

Table 3. Validation results of the learning tool for the Project Based Learning model integrated with local wisdom of Sasambo

No	Component	Average	validity category	reliability value	reliability category
1	Semester Learning Plan	3.89	very valid	97.64	reliabel
2	Lecture Session Plan	3.91	very valid	97.91	reliabel
3	Student Activity Worksheet	3.97	very valid	98.84	reliabel
4	Entrepreneurial Science Thinking Test	3.82	very valid	92.70	reliabel

The validation results of the project based learning model integrated with Sasambo local wisdom by three validators with experience in science education indicate that the content and construct validity are very valid and reliable. The Project Based Learning model integrated with Sasambo local wisdom encompasses social systems, syntax, reaction principles, support systems, instructional effects, and accompanying effects (Joyce & Calhoun, 2024). The developed learning model consists of six syntax phases: (1) Project Orientation, (2) Problem Identification in Groups, (3) Information Gathering, (4) Project Design, (5) Project Implementation, (6) Presentation and Evaluation. The social system and reaction principles are evident in the activities of lecturers and students within the learning plan. The tools and materials used are aligned with the teaching materials in the lesson plan related to the topics of electrical circuits and miniature ecosystems. The support system is reflected in the use of tools and materials in the learning plan. The instructional and accompanying effects are visible through the learning indicators aimed at fostering entrepreneurial science thinking. Based on the criteria of model consistency, the Project Based Learning model integrated with Sasambo local wisdom is designed logically and rationally, as evidenced by the validity test results showing that all components have high quality and meet the standard characteristics of effective learning. This model fulfills all the features that demonstrate logic and rationality as empirical evidence and a logical theoretical foundation for its planning and implementation, including teaching behaviors/activities, learning environment, assessment, and evaluation (Arends & Kilcher, 2010).

The Project Based Learning (PjBL) model integrated with Sasambo local wisdom provides dual benefits for students and regional educational development. For students, this model trains critical, creative, and innovative thinking skills through the application of science in projects based on local culture (Nurwahidah et al., 2022), such as agricultural processing, craft development, or environmentally friendly technologies. This approach fosters an entrepreneurial spirit with the ability to create competitive products while preserving culture. Meanwhile, for regional educational development, this model enhances curriculum relevance to local potential, encourages community-based innovation, and produces graduates who can directly contribute to regional economic development (Judijanto et al., 2024). By integrating science, entrepreneurship, and local wisdom, this model becomes a strategic tool for shaping a competent generation that positively impacts the progress of the West Nusa Tenggara region.

One of the PjBL models that has been developed (Larmer et al., 2015), which outlines seven key elements in designing learning with PjBL: (1) a challenging problem or question, (2) sustained inquiry, (3) authenticity, (4) student voice and choice, (5) reflection, (6) critique and revision, and (7) a public product. Meanwhile, the concept of entrepreneurial science thinking is developed with five elements: (1) observe, (2) new idea, (3) innovation, (4) creativity, (5) society (Syukri et al., 2013). Based on the validation results of the project based learning model integrated with Sasambo local wisdom as presented in Table 2, it was found that the developed model is valid and reliable. Some suggestions from experts for the improvement and development of the project based learning model integrated with Sasambo local wisdom include the need for a detailed explanation and in-depth analysis of theoretical

and empirical studies, complemented by additional references, and the exploration of weaknesses in previous models to be considered in the development of the model. By making improvements according to expert feedback, the resulting project based learning model integrated with Sasambo local wisdom can enhance entrepreneurial science thinking.

To support the implementation of the project based learning model integrated with Sasambo local wisdom, the researcher also developed learning tools and conducted validation of the developed tools. Based on the validation results presented in Table 3, the semester learning plan, lecture session plan, student worksheet, and entrepreneurial science thinking test have been found to be valid and reliable. Expert suggestions for improving the Semester Learning Plan include making the learning steps more detailed and ensuring that the learning objectives for entrepreneurial science thinking are more meaningful. For the lecture session plan, experts provided feedback on aligning graduate learning outcomes with course learning outcomes and indicators. Regarding the student worksheet, experts suggested that it should clearly reflect the characteristics of the project based learning model integrated with Sasambo local wisdom. For the entrepreneurial science thinking test, it was recommended to include scoring criteria for each question, and for the innovative indicators, to create questions that prompt different thinking from what already exists. The researcher has made revisions based on expert feedback to refine the developed learning tools. High quality learning tools can support the implementation of a learning model (Berndtsson et al., 2020; Mavilidi et al., 2021). The revised learning tools can be used to support the implementation of the project based learning model integrated with Sasambo local wisdom to enhance students' entrepreneurial science thinking.

Based on expert evaluations, the developed model is capable of fostering students' entrepreneurial science thinking. Entrepreneurial science thinking is a process of creatively and innovatively integrating scientific knowledge with entrepreneurial-oriented thinking (Bacigalupo et al., 2016). The concept of entrepreneurial science thinking originates from the combination of scientific process skills and entrepreneurial thinking to produce students with entrepreneurial character (Buang et al., 2009). The instrument for measuring entrepreneurial science thinking was developed (Ahmad & Siew, 2022) based on the Entrepreneurial Science Thinking Model (ESTM), which consists of five indicators: observation, new ideas, innovation, creativity, and value. All indicators of entrepreneurial science thinking can be fostered through the syntax of the developed learning model

CONCLUSION AND RECOMMENDATIONS

Based on the research findings and data analysis, it can be concluded that the Project-Based Learning model integrated with Sasambo local wisdom demonstrates excellent relevance and consistency, with criteria being highly valid and reliable. The project based learning model integrated with Sasambo local wisdom consists of six syntax phases: (1) project orientation, (2) problem identification in groups, (3) information gathering, (4) project design, (5) project implementation, (6) presentation and evaluation. The validation results of the supporting learning tools indicate that the semester learning plan, lecture session plan, student worksheet, and entrepreneurial science thinking test are valid and reliable. The project based learning model integrated with Sasambo local wisdom can be used to enhance entrepreneurial science thinking. Further research is needed to determine the effectiveness and practicality of the project based learning model integrated with Sasambo local wisdom in improving entrepreneurial science thinking. The researcher suggests expanding this study to different educational settings to evaluate the adaptability of the model and recommends investigating the long-term impact on students' entrepreneurial skills.

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