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Developing Digital Entrepreneurship Learning Model: 4-D Competencies-Based for Millennial Generation in Higher Education

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ABSTRACT

This R&D study aimed to develop a digital model of millennial entrepreneurship in universities attached to the Information System Design Analysis course with 4C competencies (Communication, Collaboration, Critical thinking, and Creativity). The problem is that students only make software to fulfill course assignments without thinking about the usefulness of the software they produce as a means of digital entrepreneurship. The research method used was a 4-D development model consisting of 4 stages: Definition, Design, Development, and Dissemination. The literacy model testing carried out showed that the average score was 0.840, which stated that the model was distributed as valid and doable to use. The average results of the practicality assessment of the operation of the Digital entrepreneurship literacy model grounded on the perception of the experimental class scholars were 87 in the practical order. The results show that the digital entrepreneurship model encourages students to open businesses using information technology. The development of this entrepreneurship digital learning model can train students to have an entrepreneurial spirit. In addition, it can improve students' skills in 21st-century literacy.

1. Introduction

The development of information and communication technology in the 21st century demands a change in the educational process because most of the work that humans usually do at this time has been replaced by machines with increasingly sophisticated technology. These changes lead to disruption. With a shift in the learning paradigm of the 21st century, Joseph Schumputer, an expert in entrepreneurship, stated that creating entrepreneurship in the technological era will be a source of economic strength worldwide. Thus, the formation of entrepreneurial character in the educational process must be a concern to achieve excellence in 21st-century competition. Remote teaching is a specific concept born of the pandemic situation. It combines the features of distance and online learning. Although it has many possibilities (flexibility, individual learning paths), its limitations and difficulties may also arise (low digital competence of the participants; lack of tools and personal connection) (Jamalova, 2022) (Bereczki et al., 2020) (Nedda & Bernadett, 2020). Creativity, innovation, autonomy, and problem-solving allow students to improve their skills. (Wickey et al., 2022).

The rapid development of technology cannot be denied bringing innovation that can play an essential role in education. In this case, technological advances touch various aspects of individual lives (W. Stone & Baker-Eveleth, 2013). Improving understanding and reusing these resources can be done by adopting digital technology to analyze and manage learning resources. (Jiang, n.d.). Using technology web and mobile applications has resulted in creating educational applications. (Engel et al., 2021). Technological advancements have an impact on the use of digital applications in education. (Sefriani et al., 2022). The ability to master digital technology is essential to keep up with the latest technological advancements (Chan & Zhang, 2019). For this reason, the government must be more responsive to adapting technology to the needs of the continuously updated people (Munafi'ah, 2021).

In the educational process, technology is used like any other tool because technology is part of the learning process, and learning is a cognitive process to achieve knowledge. (Aparicio et al., 2016). The learning process consists of several elements that influence each other, namely educators, students, teaching materials, and the

interrelated environment in achieving learning objectives (Susanti & Ummah, 2021). Teachers need to improve the teaching and learning system by providing valuable resources and activities for students through technology (Bousbahi & Alrazgan, 2015). Learning devices are arranged according to the learning model used by the teacher and are considered the most effective in achieving learning objectives (Candra et al., 2020). Many new types of learning have a deeper understanding of the discipline combined with emotional intelligence, critical thinking, and creativity (S. R. Ningsih et al., 2022).

Technological developments that are very rapid at this time, and the existence of internet facilities, the use of teaching media by utilizing E-Learning media can be done. Using this teaching media allows the learning process to be carried out more effectively, efficiently, and practically. In addition, the learning process can also be more interesting for students. Higher education needs to review the role of information and communication technology (ICT), in particular reviewing the effectiveness of online learning in higher education. The quality of Indonesian education cannot be separated from digital technology, so, naturally, there are differences in the quality of education in various regions of Indonesia. Regions with the support of adequate technological facilities, both infrastructure and technological devices in learning, have a better quality of education than regions with inadequate supporting facilities for the use of technology. The Digital era makes knowledge available in the classroom, and anywhere there are digital technology devices. (Traverso et al., 2014).

An entrepreneur creates a new business by taking risks and uncertainties to achieve profit and growth by identifying opportunities and combining various resources (Sudarmiatin, 2009). This research aimed to develop a digital model of entrepreneurship in universities to create a millennial with an entrepreneurial spirit in the Information System Design Analysis course with the 4C competency formulation (*Communication, Collaboration, Critical thinking, and Creativity)*. The main reason for developing entrepreneurship learning models in the digital era based on new literacy in the era of the industrial revolution 4.0 is the need for college graduates to survive in the digital era. It is by having a new set of competencies to be able and skilled to become a professional with critical and creative thinking as an industrial agent in the digital age. The digital entrepreneurship learning model in the 4.0 industrial revolution era is a design of learning steps with a syntax arrangement referring to project- and product-based learning. The learning model is a pattern always used to guide classroom learning and tutorials for university lecturers. The learning model must refer to the approach, including learning objectives, environment, and classroom management (S. Ningsih et al., 2019).

The digital entrepreneurship model was developed with the characteristics of learning steps that lead students to have the ability to become entrepreneurs in the digital era by implementing new literacy skills 4.0. This model applies to courses or subjects taught in practical vocational schools.

The formulation of new literacy in education and the challenges of the 4.0 industrial revolution era, which has the concept of Internet of Things (IoT) thinking, has given rise to the phenomenon of disruption. Disruption is a fundamental change in human life due to the evolution of information technology, which changes almost the entire order of human life, including business and work activities. Therefore, this phenomenon must be taken seriously in the educational environment. Furthermore, with significant changes in the era of disruption, the needs of student competencies must undoubtedly be adjusted to the demands of job competition.

This study aimed to develop a digital entrepreneurship learning model in universities to realize an entrepreneurial millennial generation in Information System Design Analysis (APSI) course with the 4C competency formulation (Communication, Collaboration, Critical thinking, and Creativity). The problem is that the software produced by students is only limited to fulfilling assignments in the APSI course without thinking about using the software they produce as a means of digital entrepreneurship. They should be able to use the software to open digital-based entrepreneurs. The digital entrepreneurship learning model encourages students to open businesses by utilizing the information technology they have built in the APSI course. This research is important because applying this model can encourage students to be entrepreneurial by building an information technology-based system according to their field.

The main reason for developing entrepreneurship learning models in the digital era based on new literacy in the era of the industrial revolution 4.0 is the emergence of the need for university graduates to be able to survive in the digital era by having a new set of competencies to be able and skilled to become a professional who has critical and creative thinking as an industrial driver in the digital age.

The digital entrepreneurship learning model in the 4.0 industrial revolution era is a design of learning steps with a syntax arrangement referring to project- and product-based learning. The digital entrepreneurship model was developed with the characteristics of learning steps that lead students to have the ability to become entrepreneurs in the digital era by implementing new literacy skills 4.0. This model can be applied to courses or subjects in practical vocational schools.

Theoretically, the results of this study further strengthen the argument of urgency and the allegation that it is necessary to develop a learning model to fulfill the needs of human resource capabilities in the 21st century, which is getting more vital with challenges and global competition as well as responding to the demands of the ability of higher education graduates in mastering new literacy in the industrial revolution 4.0.

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2. Literature Review

Researches relevant to developing digital entrepreneurship models are presented by John P. Ulhøi (2021), Aarhus University, Business and Social Sciences, Department of Management, Aarhus, Denmark, with the title Digital Perspective on Entrepreneurship. This study is about the broader impact of digital technologies on entrepreneurship, which has only recently begun to surface in the literature. This situation invites for re-examining of theory on digital technologies and theory on entrepreneurship while simultaneously asking where to find critical bridging points that may allow for integrating the two domains.

This paper answers this question by reviewing and analyzing the core constituents of digital entrepreneurship and its modus operandi. The analysis showed that digital entrepreneurship involved entrepreneurial agency and digital technologies and affected previous conceptualizations of artifacts and its modus operandi by applying a broader repertory of architectural arrangements. It implied that the employment of digital technologies in entrepreneurial ventures had effects beyond using digital technology as a means to an end. Before closing, implications for future research and relevant policymakers were briefly sketched. More specifically, it could be interesting in future research to test how more recent innovation approaches may affect digital entrepreneurship.

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Research from Mohd Zaidi Abd Rozan, Information Systems, Universiti Teknologi Malaysia (2022) with the title Evidence of Impact from a National Digital Entrepreneurship Apprentice Program in Malaysia. This study is about the Impact Digital Entrepreneurship Apprentice Program (IDEA@KPT) at the Ministry of Higher Education Malaysia 2021 is a comprehensive nationwide six-month program. Forty-three teams consist of 43 Academic Supervisors, 129 institutes of Higher Learning students, and 43 Micro & Small Enterprises (MSE) owners conducted by Universiti Teknologi Malaysia. The program is aimed to develop capable students in maneuvering the digital business world. Students underwent an online Business and Digital Training, with apprenticeship and formal reporting.

This article aimed to present the impact of IDEA@KPT activities by analyzing 43 case studies produced in the program. A pre-codification scheme that concentrates on the study goals was the method for data collection. Before the program, all the teams were informed of the required components to ensure uniformity of the report. The evidence of significant gain and impact on the MSEs businesses was drawn from the components. Other than the components, analytics hindsight, visual appeal, persuasion ability, perception of paid ads, posting timing, and synergies beyond the digital world activities were gathered, providing richer information and insights that increase business value. Such lessons benefit all parties as all businesses are demanded to utilize digital platforms.

The most critical element for The success of IDEA@KPT or digital marketing internship program is the confidence of all participants. Businesses are looking for a chance to become highly visible, likable, engaged, and profitable online. By tweaking the intern's marketing elements, MSE owners must be ready to take over the role and transform digitally. It is essential to maintain the business because it is considered to be able to realize higher success, especially after and after the Covid-19 pandemic. (Rozan, 2022).

Research by Muafi et al., (2021) with the title Digital Entrepreneurship in Indonesia: A Human Capital Perspective. This study aimed to make Digital technology a new economic and social force, reshaping traditional business models, strategies, structures, and processes. It

is a challenge for human capital to develop continuously in this dynamic era; one of the solutions is digital entrepreneurship. Digital entrepreneurship focuses on creating new ventures and transforming existing businesses by developing novel digital technologies or novel usage. Further, digital technology has also enabled the growth of the sharing economy, linking owners and users and disrupting the previous dualism of businesses and customers.

This paper provided a novel contribution to the emerging concept of Digital Entrepreneurship. Based on a qualitative literature review and interview with university staff, lecturers, and students in four large public and private universities in West Java and DIY Province, an interpretative framework for Digital Entrepreneurship was proposed, which comprises the following components: motivation (the rationale for the adoption of digital technology for academic entrepreneurship), stakeholders (the stakeholders involved through digital technology to achieve the academic entrepreneurship goal), process (the processes of academic entrepreneurship supported by digital technologies), and business form (the emerging forms of digital academic entrepreneurship).

This research also showed several alternative government policies to improve digital entrepreneurship in the academic environment. This study provided theoretical implication that digital academic entrepreneurship could be developed by increasing the role of motivation and stakeholders, especially those who would contribute to digital academic entrepreneurship's process and business form.

The managerial implication provided in this study was that universities must develop several things in implementing and developing digital academic entrepreneurship. The first factor is motivation. In its implementation, the motivation that grows in students in digital academic entrepreneurship has been excellent. Therefore, the next thing that needs to be done by universities is to maintain these motivations by continuing to motivate students in lectures and other agendas outside the campus, such as seminars, workshops, student clubs, study groups, and others.

The second factor is a stakeholder. The implementation of the functions of stakeholders is generally good, but several things need to be improved, namely the low mentality of students and complicated administrative requirements. Therefore, universities should further stimulate and develop student mentality and simplify the administrative requirements for students who wish to submit entrepreneurship proposals. The third factor is the process. Although universities already have a good system, implementing student business ideas is still inadequate due to a lack of experience, knowledge, skills, and curiosity. The formation of digital academic entrepreneurship is still weak.

Therefore, universities must provide more intense assistance and conduct regular entrepreneurial training and practice. Furthermore, the fourth factor is sustainability. Implementing this factor is still very weak because many student businesses do not last long. Therefore, universities should think further about student business development, especially after launching the business. Universities should form a team of experts in student business supervision so that business steps can be more focused and well-controlled (Muafi et al., 2021).

3. Method

This Research and Development (R&D) was used to examine the learning model development. Then, it was validated by experts (Isolihatun, 2012). The validation assessment sheet was a questionnaire for five indicators with an assessment using a Likert scale. The test questions were related to Information System Design Analysis textbook material. The response questionnaire using this model contains two types of statements given to the test subjects. The researchers created the questionnaire using the Guttman Scale in the positive and negative statements. The three instruments were analyzed using data analysis techniques: product validity tests, product practicality tests, and product effectiveness tests.

This digital entrepreneurship model was tested for validity to obtain good product development. The level of validity of the product developed resulted in a percentage value. The achievement of learning effectiveness using the digital entrepreneurship model was said to be effective if all aspects of effectiveness were met (Wahyuni, 2017).

The main purpose of development in education and learning is to stimulate alternative learning methods in educational preparation to meet the challenges of developing learning needs. Research and development are carried out by introducing concepts, methods, and practices used by educators as instructional implementers. In this study, the course of information system design analysis produced a product in the form of a digital entrepreneurship model. Students' competence and level of entrepreneurship in these courses can increase through this developed digital entrepreneurship model. This research is a development of previous research. The learning device development model used was the Thiagarajan and Semmel learning device development model (Lawhon, 1976), namely the 4-D model. This 4-D development model consists of 4 stages: the definition stage, the design stage, the developing stage, and the disseminate stage (Sugiyono, 2006). The concept of the 4D model is illustrated in Figure 1.

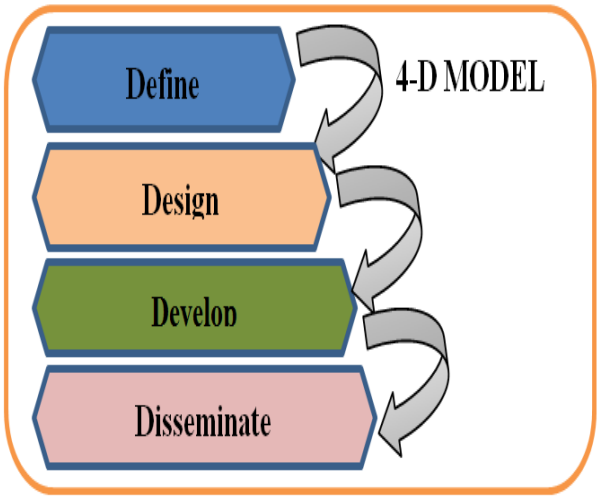

Figure 1. The concept of 4-D

a) Define; Define is the stage of establishing and determining the instructional requirements in its development. The researcher only carried out the analysis to suggest instructional suggestions and limitations. There are four activity steps in the Define stage:

(1) Front-end analysis is the stage where researchers study the fundamental problems educators face that cause low performance and achievement of educational outcomes.

(2) Learner analysis is an action where researchers conduct studies on students who are the target of training to identify characteristics of students that are relevant to the instructional design and development that will be carried out. (3) Task analysis is an empirical analysis to identify the primary skills acquired by educators and their analysis into a set of required sub-skills. (4) Concept analysis identifies the main lessons that must be taught related to the learning objectives developed.

The Define phase shows that the achievement of learning outcomes for APSI courses is not optimal due to the frequent use of the application of student practice results, needs analysis in high category APSI learning,

b) This stage links Stage 1 (Define) and the Design Process (Design). This stage aims to design prototype materials from the developed materials. The selection of learning media and formats is a major aspect of the design phase. The following activities are carried out in the Design stage:

(1) The constitution criterion-referenced test is a phase where educators prepare the criteria/standards for the specified test. The preparation of test criteria is based on Task Analysis (Define) referred to by references, and educators carry out development by changing objectives into teaching outlines to develop teaching materials.

(2) Media Selection is selecting the suitable media to be presented in the instructional. This process involves task matching and analysis, target-trainee characteristics, production sources, and dissemination plans with different media attributes.

(3) Initial Design is the initial design through activities to adjust basic needs through appropriate models and media. Activities at this stage are the arrangement of learning activities and completeness of learning.

(4) The design phase has designed the development of learning models and support systems through the design, development, and revision stages. (4) Forum Group Discussion (FGD) to solicit opinions of experts and practitioners regarding the product being developed. The results of the FGD became the design determination to be revised and prepared for testing.

c) At the development stage, feedback is received through formative evaluation. The two steps in this stage are:

(1) Expert Appraisal is a technique to get an expert judgment. Several experts were asked to evaluate the initial design from an instructional and technical point of view. The developed products are modified to be more suitable, effective, functional, high-quality, and valid as a basis for feedback.

(2) Developmental Testing: Developmental testing involves the efforts made by the researcher to find the parts that are not right. Based on feedback, reactions, and user comments as a basis for improvement and modification. The assessment is related to the practicality and effectiveness of product development to optimize learning outcomes. The development phase is the point of testing the validity, practicality, and effectiveness through applying learning models in the experimental group.

d) Disseminate; The development results reach the final production stage when the tests produce consistent results and expert judgments produce positive results on the summative evaluation. The three steps at this stage are:

(1) Packaging. Packaging is a preparatory activity before the product is distributed to users.

(2) Diffusion. Diffusion is making efforts to distribute products to users.

(3) Adoption. Adoption is the use of material through other developments. Disseminate phase is the phase that in this study was only limited to the experimental group as the research sample.

This digital entrepreneurship learning model is an entrepreneurial activity using electronic (digital) facilities included in the learning process with new literacy in the era of the industrial revolution 4.0, a 21st-century learning framework. The flow of this research can be seen in the conceptual framework of research contained in Figure 2.

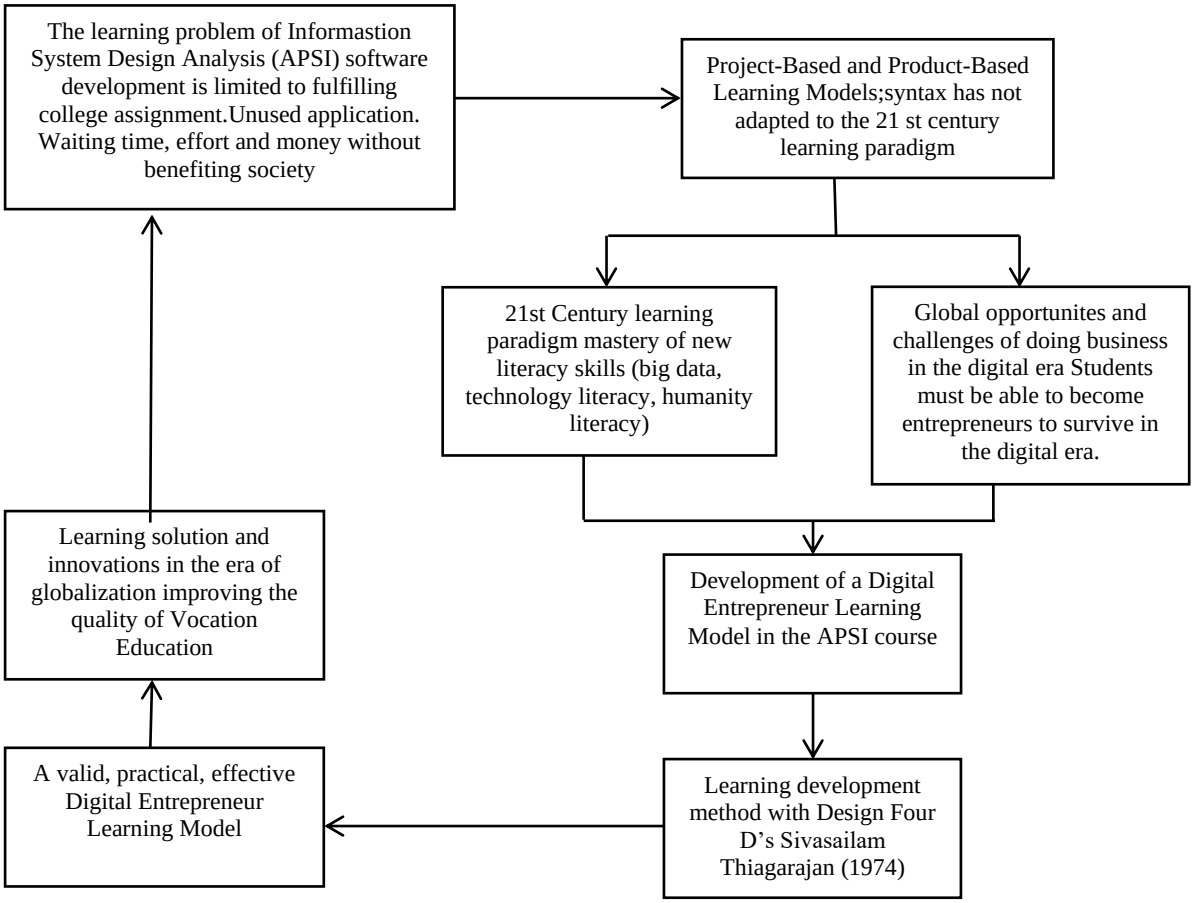

Figure 2. Conceptual Framework of Research

4. Results

This study aimed to develop a digital entrepreneurship model to encourage students to have an entrepreneurial spirit. This research and development have resulted in a valid, practical, and effective learning model called the Digital Entrepreneurship learning model. The research discussion followed the stages of research and development carried out in this study, namely define, design, develop and disseminate. The research subject is the Digital Entrepreneur learning model with new literacy in the era of the industrial revolution 4.0 in the Information System Design Analysis (APSI) course. The test subjects were UPI YPTK students who took APSI lectures in the odd semester of the 2020/2021 academic year.

4.1 The Concept of the Entrepreneurship Digital

As we know that 21st-century learning emphasizes the ability of students to find out from various sources, formulate problems, think analytically and collaborate and collaborate in solving problems.

Responding to the challenge of mastering 21st-century competencies to adapt to new literacy in the era of the industrial revolution 4.0, the students can have global competitiveness by mastering significant data literacy, digital literacy, and human literacy to strengthen the entrepreneurial spirit through learning activities. Meanwhile, educators must strive to improve quality learning becomes more effective and efficient. It aims to make learning more optimal and lead to the principles of vocational learning by familiarizing students with

working in the learning process to achieve an ability to adapt to the needs of the world of work and society. The basic concept of the Digital Entrepreneurship Model is 4C competencies (Communication, Collaboration, Critical thinking, and Creativity). Figure 3 illustrates the model concept.

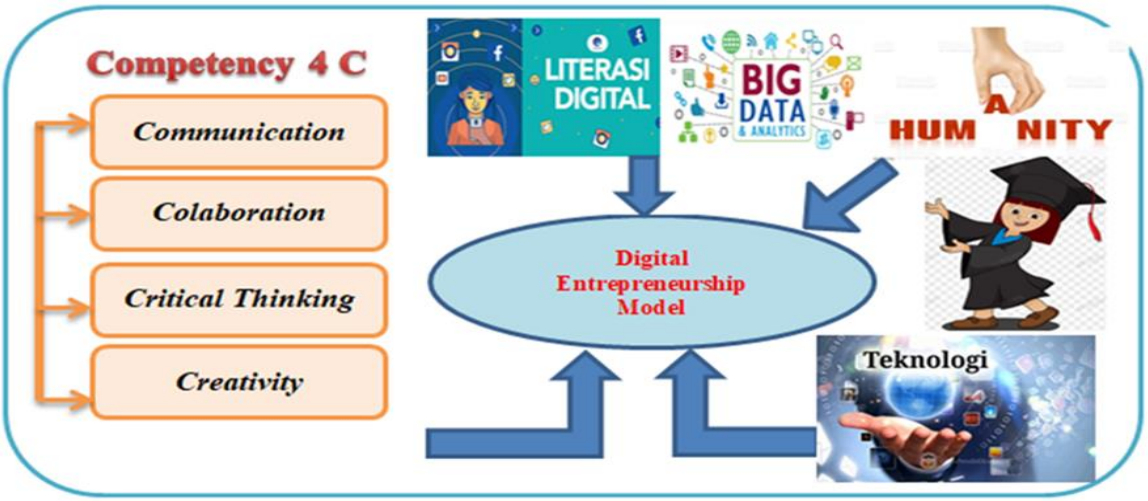

Figure 3. The Concept of the Digital Entrepreneurship Model

Figure 3 illustrates how competency 4-C shapes the development of this digital entrepreneurship, which consists of Communication, Collaboration, Critical thinking, and Creativity. In this case, students in the Information System Design Analysis course learn how to make an application of sale value to open a digital-based business.

4.2 Steps of the Digital Entrepreneurship Learning Model

The steps taken in implementing the Digital entrepreneurship learning model consist of 8 phases.

They are (1) conception, (2) cognition, (3) analysis of digital project needs, (4) digital project business plan, (5) development of digital products, (6) digital project review, (7) digital project reporting and (8) feedback. The 8th phase is a procedure in the digital entrepreneurship learning model. This step starts from the procedure for opening the lesson, the core, and closing the lesson. Learning steps can be seen in Figure 4.

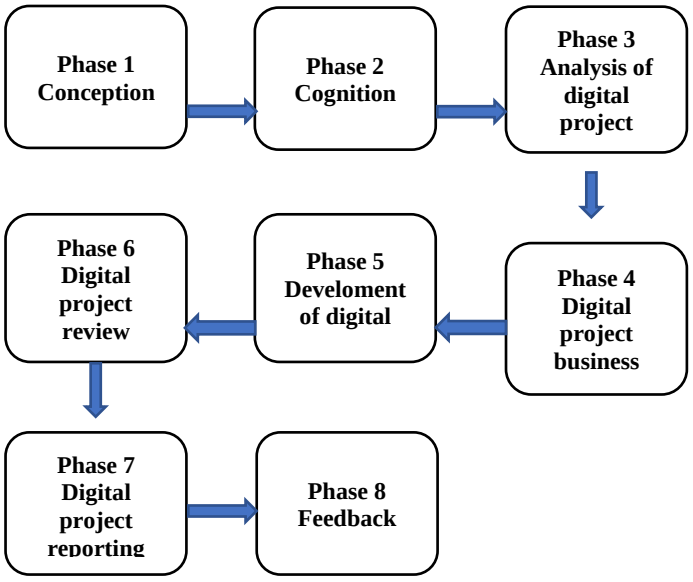

Figure 4. The Steps of the Digital Entrepreneurship Learning Model

The steps in this model are adjusted to the achievement of expected competency standards and learning needs of the globalization era in 21st-century learning. It requires students to have the ability to apply new literacy in the era of the industrial revolution 4.0.

4.3 Use Case Diagram

Use Case Diagram describes the actors involved in the system and significant activities (cases) that will occur in the system (Ningsih S.R., et al., 2019). In this information system, there are two users, namely lecturers and students. Lecturers are users who act as instructors who can create classes, accept students who join in their classes, give assignments, and give ratings and comments. In comparison, students are users who can register, join the class that the lecturer has made, collect assignments, and comment. Find out what interactions between users and this information system and the functions that user lectures can perform can be seen in Figure 5.

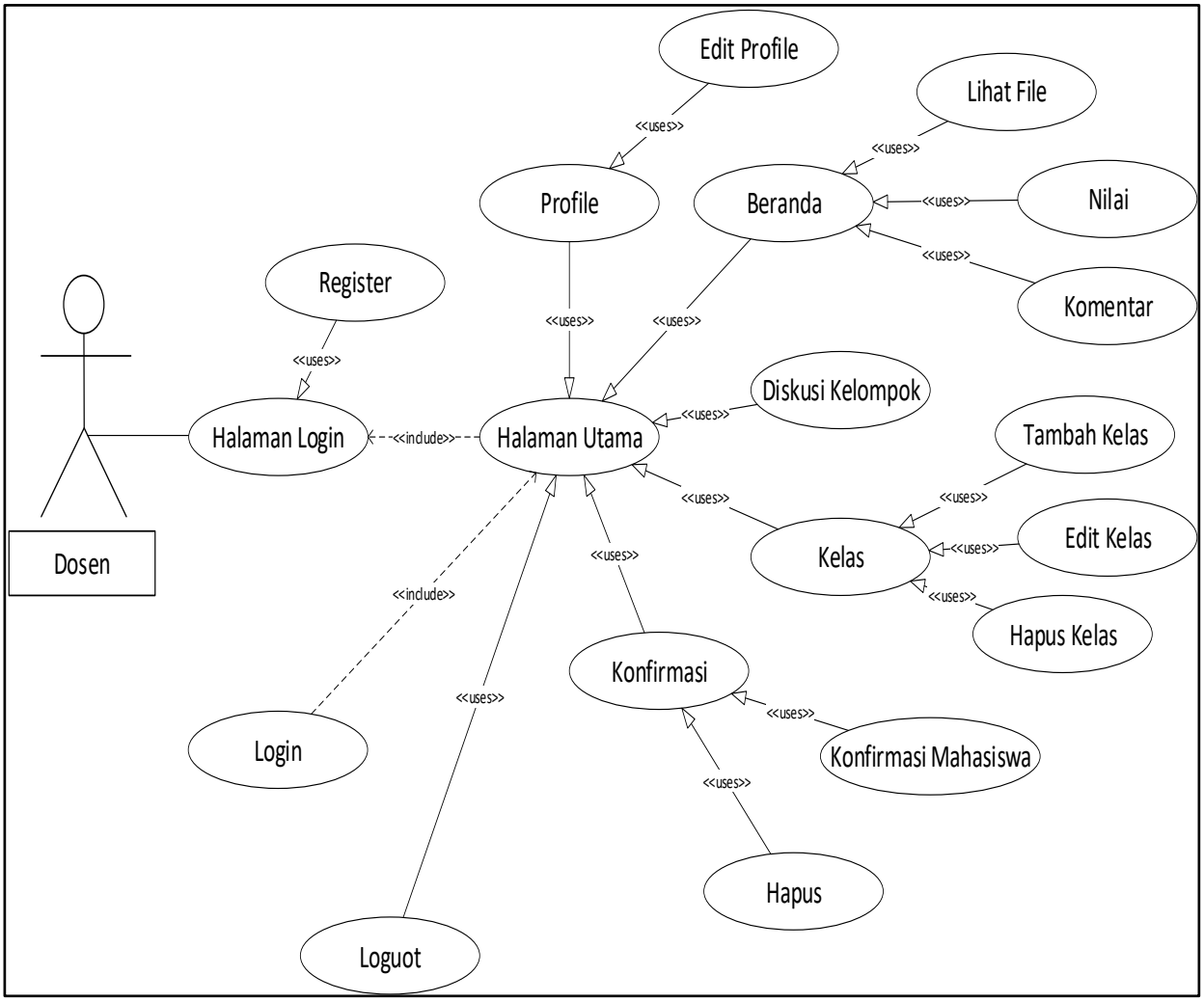

Figure 5. Use Case Diagram Lecturer

From figure 5, when the lecturer opens the login page, then on page, this login lecturer can register if the students do not have an account to log in. After registering, the lecturer can log in and select the menu available on the main page. The menu includes profiles to view and edit, the home page to see tasks, provide values and comments, create new classes, edit and delete classes, confirm students who will join the class, and log out to exit the main page. For interactions and functions that students can perform can be shown in Figure 6.

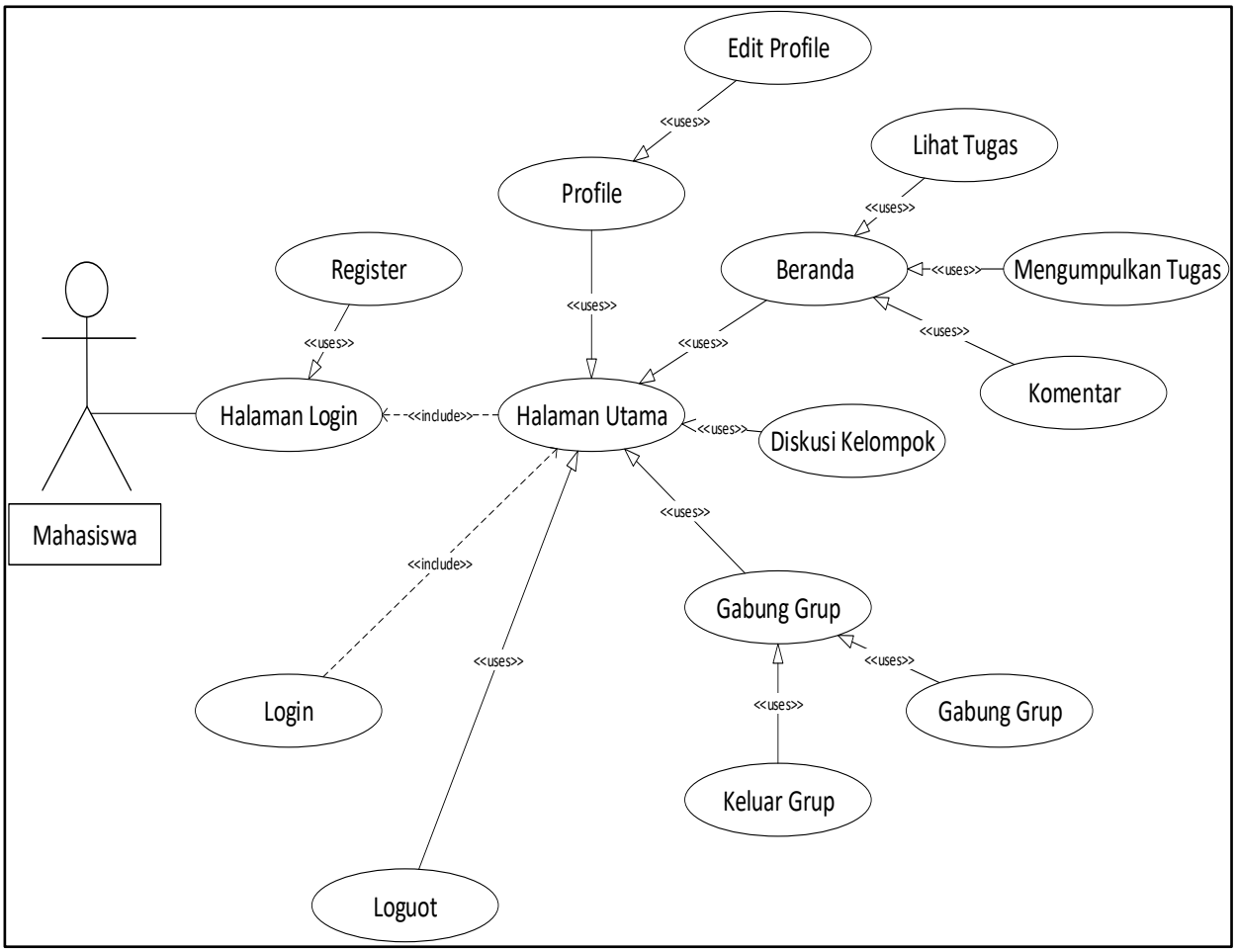

Figure 6. Use Case Diagram Students

In Figure 6, students open a login page to log in to the main page, and if they do not have a login account, students can choose to register to create a login account. On the main page, students can choose the menu profile to view and edit profiles, the homepage to view blunt tasks and comments, join groups and exit groups, and log out to exit the main page.

4.4 Class Diagram

In this system, the user can perform several classes and functions. One of these classes is a profile class. This class is used to edit and view profiles. Meanwhile, the homepage of this class serves to display assignments and comments, who have submitted assignments, view grades, and conduct assessments. Furthermore, class registration functions to register to the system, add classes, edit, delete, and search for classes. Finally, the assignment class serves to view files, provide assessments and submit assignments. These classes can be seen in Figure 7.

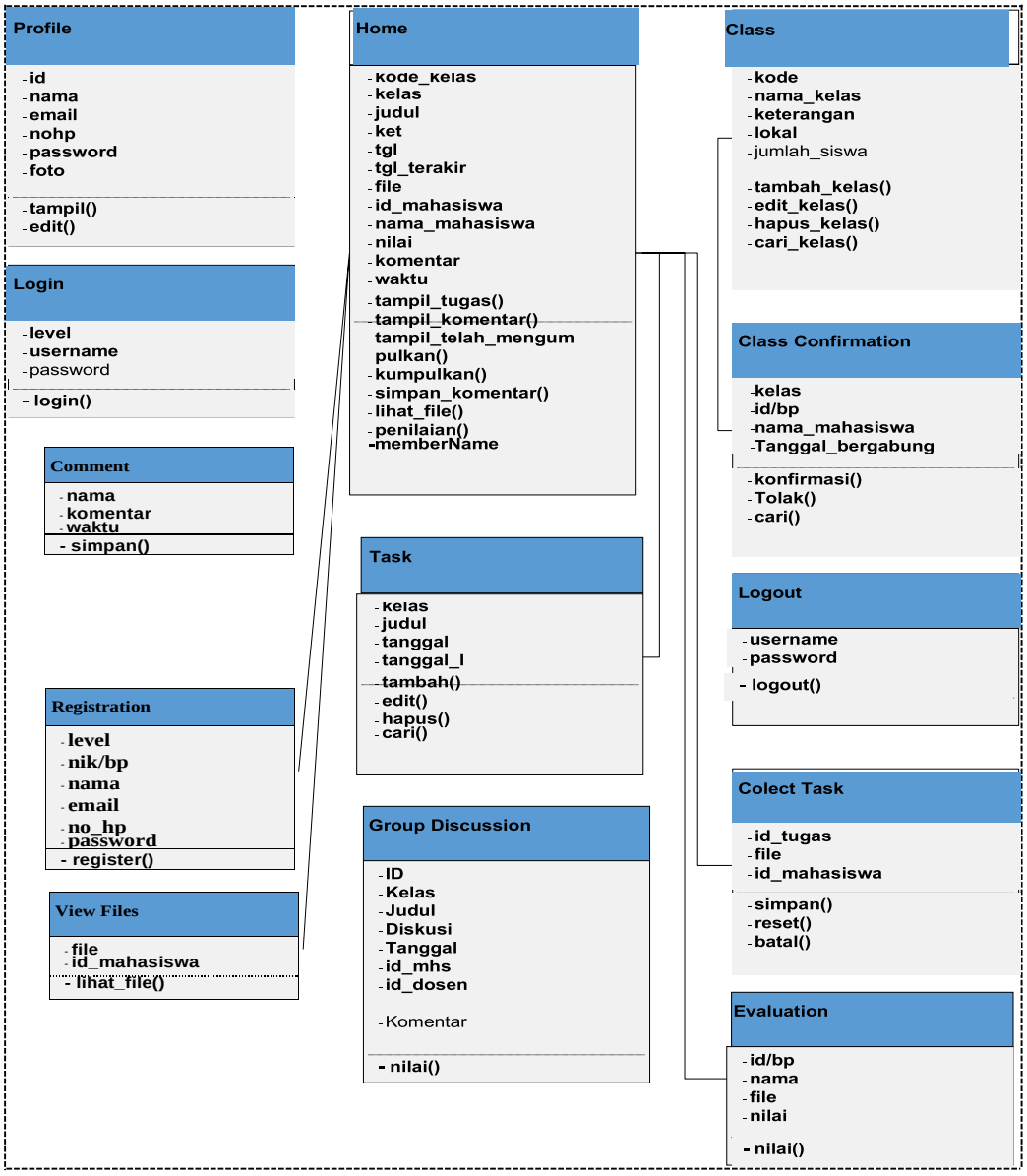

Figure 7. Class Diagram

4.5 System Implementation

The system implementation stage completed the system development design in the approved document. Then, it was used to test, install and start using the new system. The objective of the implementation phase was to complete the approved system design. The next step was to test and document the required system programs and procedures and ensure that the users involved could operate and use the new system correctly and transition from the old system to the newly developed system. At this stage, the author described the results of testing the implemented system. Testing is done by running the system, then observing whether the results are in accordance with the requirements specifications. Tests carried out on system functions can be seen in Table 1.

Table 1. Test Module

System Description		System Testing Procedure	System Test Results
Before research	**After being applied to the system The proposed**		
The implementation of the online learning system has not been adequately integrated by the parties academic	This learning model provides opportunities for students to be able to open entrepreneurship from the results of their work	Show login menu. Enter username password and select level.	Successfully logged in, and the main admin, lecturer, and student pages appeared. Please select according to the level or needs of users
The APSI learning process is only limited to collecting assignments	With this digital entrepreneurship model, it can provide motivation and encouragement to students to have an entrepreneurial spirit	Login menu. Enter username password Choose student level Click Register the task is then uploaded the task from the submit task menu	Students collect assignments from lecturers, and lecturers give grades according to the deadline for submitting the assignment.

4.6 Results of Analysis of Digital Entrepreneurship Model

1) Results of Validity Test

The learning model developed was tested for validity, practicality, and effectiveness. The results of the validity analysis of the developed model can be seen in Table 2.

Table 2. Validity Test Results on The Digital Entrepreneurship Learning Model

Number	Indicators assessed	Score	Category
1.	Rationalization	0.823	Valid
2.	Supporting Theory	0.858	Valid
3.	Syntax	0.825	Valid
4.	Social System	0.870	Valid
5.	Reaction Principle	0.798	Valid
6.	Support System	0.817	Valid
7.	Impact	0.889	Valid
	Average	0.840	Valid

The learning model testing showed that the average score was 0.840, which stated that the model was valid and feasible.

2) Practicality Test Results

The practicality test is based on student perceptions. Questionnaires assessed an experimental group of students who learned to use the Digital entrepreneurship model. The summary of the results of the practical analysis can be seen in Table 3.

Table 3. Results of Practicality Analysis of Student Assessment

Number	Practicality on Product	Score	Category
1.	Learning model	89	Practical
2.	Module	85	Practical
3.	Learning Guide	87	Practical
	Average	87	Practical

The practicality test results presented in Table 3 showed the average results of the practicality assessment of the Digital Entrepreneurship application based on the perception of experimental class students was 87% with the practical category.

3) Effectiveness Test Results

To determine the success of designed product development, the researchers analyzed learning outcomes to see the effectiveness of test results in the cognitive, affective, and psychomotor domains. The experimental research method for seeing the learning model's effectiveness was the experimental research method.

a) Cognitive

The cognitive domain is the area of knowledge possessed by students after participating in the learning process. To test whether there was a difference in students' level of knowledge in the control and experimental groups, the researchers conducted assessment objective tests on the competencies presented in modules 1 and 2. Table 4 shows the data results described on the level of student knowledge.

Table 4. Data Description Of Average Learning Outcomes In The Cognitive Area

Descriptive Statistics					
Class	N	Minimum	Maximum	Mean	Std. Deviation
Experiment	50	70.00	95.00	83.44	5.56
Control	44	65.00	87.00	77.54	5.83

According to Table 4, the average cognitive learning outcomes of the experimental group were 83.44, while the control group was 77.54. The data were obtained from the combined cognitive test results of module 1 and module 2. The description of cognitive learning outcomes indicated that the experimental group had better learning outcomes than the control group.

b) Affective

The average results of the description of affective learning based on new literacy behavior in the 4.0 industrial revolution era taken from the experimental class and control class data can be seen in Table 5.

Table 5. Description of Average Learning Outcomes Affective Area

Experiment		Control	
Literacy Big data	80 %	Literacy Big data	73%
Technology literacy	83%	Technology literacy	66%
Literacy Humanity	85%	Literacy Humanity	70%
Critical thinking	(80%)	Critical thinking	(65%)
Creativity	(85%)	Creativity	(66%)
Communicate on	(89%)	Communication	(78%)
Communication	(89%)	Communication	(78%)
Communication	(89%)	Communication	(78%)
Average	82.67%	Average	69.67%

Table 5 displays the data on the effectiveness test results in the affective domain for each indicator. The test results of the effectiveness of the affective domain of each indicator for the experimental group showed an average of 82.67%, compared to the control group with an average result of 69.67%.

c) Psychomotor

The psychomotor domain is the area of skills shown by students in the practice of learning APSI. The description of the basic statistics of the psychomotor domain research results for the experimental and control groups can be seen in Table 6.

Table 6. Data Description of Average Psychomotor Learning Outcomes

Descriptive Statistics					
Class	N	Minimum	Maximum	Mean	Std. Deviation
Experiment	50	67.00	91.00	80.50	7.20
Control	44	52.00	89.00	68.70	10.62

Based on Table 6, the average affective learning outcomes score based on humanity in the experimental group was 80.50 and 68.70 in the control group. The affective learning outcomes described that the experimental group has better affective learning outcomes than the control group. For affective domain learning outcomes for each indicator can be seen in Table 7.

Table 7. Affective Area Learning Results In Each Indicator

Descriptive Statistics

Class	N	Minimum	Maximum	Mean	Std. Deviation
Experiment	50	73.00	96.00	87.20	5.28
Control	44	56.00	96.00	74.79	11.00

Based on Table 7, it was known that the average psychomotor learning outcomes score of the experiment group was 87.20, and the control group was 74.79. The explanation of learning outcomes in the control and experimental groups in the psychomotor domain for each indicator can be explained in Table 8.

Table 8. Psychomotor Learning Outcomes on Each Indicator

Experimental		Control	
Correctness	85%	Correctness	78%
Consistency	88%	Consistency	80%
Traceability	86%	Traceability	75%
Usability	87%	Usability	81%
Reliability	88%	Reliability	70%
Effectiveness	89%	Effectiveness	65%
Average	87,2%	Average	74,8%

Learning outcomes in the psychomotor domain were assessed by assessing the results of student practice in project work 1 and 2. The assessment was carried out on three project planning activities, project assessments, and project activities that were only assessed to the experimental group. The rating result is presented in Table 9. The effectiveness indicator is the most prominent difference in psychomotor learning outcomes, with a difference of 24%.

Table 9. Project Assessment

Group	Project Planning		Project Result		Project Activity	
	Project 1	Project 2	Project 1	Project 2	Project 1	Project 2
1	80	84	75	76	80	84
2	84	80	76	82	76	76
3	88	84	84	82	87	84
4	88	88	84	82	80	80
5	72	72	78	89	87	84
6	84	92	85	95	76	93
7	72	84	71	85	71	87
8	80	92	87	78	87	84
9	72	88	75	84	78	80
10	92	92	89	93	93	93
Average	81,2	85,6	80,4	84,6	81,3	84,7
	83,4		82,5		83,0	

The accompanying impact data were obtained through direct observation when students completed projects one and two in groups. The results of the observations made can be seen in Table 10.

Table 10. Observations on New Literacy Abilities in the Industrial Revolution 4.0

Literacy	Indicator	Average Score
Big data	Download, Upload, Sharing	87
Technology	Media, tecnology, information	85
Humanity	Critical thinking	74
	Creativity	83
	Collaboration	80
	Communication	86
Average		82,5

4. Discussion

4.1 Define

The development of the Digital Entrepreneur learning model indicated that the achievement of learning outcomes for APSI courses was not optimal due to the low application of student practice results. It needs analysis in high-category APSI learning. According to the Big Indonesian Dictionary (KBBI), practicality is everything practical because it comes from the primary word practical, which means that it is easy and easy to use. According to (Sugiyono, 2006), practicality is a calculation process related to the practicality of an instrument used by researchers in implementing research methods. So the terminology related to practicality itself refers to the part of a situation that involves a part that makes sense or helps do something.

A practicality test based on students' perception of the practicality assessment was carried out by filling out a questionnaire to the experimental group of students totaling 50 people who learned to use the Digital Entrepreneur model. Effectiveness is a measure of the success or failure of achieving a goal organization (Chandra et al., 2020). Effective in the Indonesian Dictionary is defined as the effect, the impression. It can be concluded that effectiveness has an effect that results from a business or action. When an organization achieves its goals, it is running effectively. The analysis of competencies that students must achieve is carried out by reviewing the curriculum and analyzing what students must master competencies after using development products (Nuryadi et al., 2022).

4.2 Design

The Design Phase has designed learning models and support systems through the design, FGD, and revision stages. Validity of the learning model that has been developed and improved according to expert input is tested to experts with a total of 5 experts, all of whom have provided input during the Focus Group Discussion (FGD). In testing the data collection instrument, the validity is divided into factor validity and item validity.

Survey research collects information from a sample of individuals through their responses to questions (Yuliana et al., 2020). This survey was designed as a descriptive quantitative study in nature and sought an answer to the research questions. The more significant the contribution of the resulting output to the achievement of the specified goals or objectives, the more effective the work process of an organizational unit. Indicators of effectiveness describe the range of effects and impacts (outcomes) of the program outputs in achieving program objectives. The effectiveness test is seen and assessed from the cognitive, affective, and psychomotor domains. Observations that have been made on technological literacy can be explained that students use information media with various technological media that can be accessed and operationalized.

To make a design, accurate data is needed, which will later be processed to produce information. The data calls for proper planning to obtain more structured learning content and goals (Abdul Razak et al., 2022).

4.3 Develop

Develop is the phase of testing the validity, practicality, and effectiveness through applying learning models in the experimental group. The Digital Entrepreneurship Model Analysis results show that this learning model is valid. According to (Dewi, 2018), validity is the accuracy or accuracy of an instrument in measurement. In testing the data collection instrument, the validity is divided into factor validity and item validity. The validity of the developed and improved learning model according to expert input is tested to experts with a total of 5 experts, all of whom are research samples—the results of the Digital Entrepreneurship.

The result data on effectiveness test results in the affective domain for each indicator indicated differences in the affective learning outcomes of students. After testing, the cognitive value obtained is 83.44 for the experimental class and 77.54 for the control class in the APSI course. It is between students who studied using the Digital Entrepreneur model in the experimental group, with an average of 82.67%, with the control group who learned using the ordinary learning model applied in APSI learning with an average result of 69.67%.

The results of the psychomotor domain test were carried out using an independent sample t-test. The results of the normality of the data show the Asimp score. The significance of the Kormogorov Smirnov test is 0.784 for the experimental group data and 0.352 for the control group data, meaning that the data are assumed to be normal. The results of the t-test analysis for the different test indicates that the score tcount = 3.715 and t table = 2.010 (df = 48. It means that the Digital Entrepreneur learning model optimizes psychomotor learning outcomes because the learning outcomes of the two groups have different learning outcomes, and the experimental group has the same score. It is higher than the control group.

Based on the research results in the psychomotor domain, the differences in students' learning outcomes can be explained. The average score of students in the experimental group is 87.2%. Meanwhile, the average score of students in the control group who learned using the ordinary learning model applied in APSI learning is 74.8%.

4.4 Disseminate

Disseminate is the dissemination phase which in this study was only limited to the experimental group as the research sample. The Digital Entrepreneurship Model Analysis results show that this learning model is valid. According to (Dewi, 2018), validity is the accuracy or accuracy of an instrument in measurement. Psychomotor learning outcomes show that students who learn to use the Digital Entrepreneur learning model who has worked on projects 1 and 2 show a good average ability in planning project 1 and very well in project 2. The results of projects 1 and 2 show good categories and project activities. 1 and 2 show good categories. Psychomotor learning outcomes show good average results in all digital entrepreneur project assessment aspects. Thus the Digital Entrepreneur learning model and practical model tools optimize psychomotor learning outcomes.

The affective learning outcomes described that the experimental group had better psychomotor learning outcomes than the control group. Based on the three test results in the cognitive, affective, and psychomotor domains, it is possible to conclude that this learning model was effectively used for experimental classes in APSI courses that use digital entrepreneurship learning models.

A previous study stated in his research that students tend to learn the most in schools because it provides a formal learning environment, but because schools have closed. Most learning has become home-based; students spend very little time studying. It has a negative impact on students for their learning achievement (Khan et al., 2022).

The expected accompaniment impact in implementing the Digital Entrepreneur learning model is the ability to carry out entrepreneurial activities through learning activities for the APSI course by applying literacy skills in the 4.0 industrial revolution era, namely big data literacy, technological literacy, and human literacy.

The results of observations made to students who carry out learning activities for digital entrepreneur projects 1 and 2 show the ability to apply significant data literacy. The things students do in this learning activity show that students have implemented big data literacy skills. Students download the assignments given by the lecturer and upload assignments and reports through the website. Students carry out business promotion activities using technology-based media. Students direct the information obtained and sort the information before use, which shows that students can already assess technology-based information media by doing wise things in using technology.

There is a need to develop resources capable of facing and overcoming obstacles and the capacity of teachers and students to adapt to renewal changes through training and sharing sessions (Rosida et al., 2021). It is known that students are proficient in using technology media. They can use digital tools to develop the projects they carry out, carry out business promotion activities through technology-based media and show an attitude of understanding the benefits of using technology for entrepreneurship.

Humanity literacy can be observed through learning activities demonstrated by students in practice. Students demonstrate critical thinking skills through the reasoning of the projects that will be chosen to be implemented. Students' critical thinking can be demonstrated through sensitivity to business opportunities that will be carried out. Thinking about the possible risks that can arise from the selection of business opportunities made by students is shown by students in project selection and project planning. Creativity appears in the form of ideas and ideas by optimizing the ability to create innovative ideas in the business being developed. When running a project, students are trained to think of solutions to problems that arise during project work. Creative thinking is shown to solve problems in completing projects.

The ability to communicate that is seen in project activities is the main task of the lecturer in directing. There is still a sense of wanting to stand out in and between groups. It can be seen that students are still not very capable of managing conflict in solving peer problems. Students should be trained more strongly in communication techniques in learning environments and activities. Meanwhile, some of the students' collaboration abilities appear to be able to contribute to learning.

Students have demonstrated oral and written communication through technological media by training them to promote projects in the community through social media and websites. The collaboration of students in groups increases during project work. Students better understand the function of collaboration in groups to achieve project goals and success.

5. Conclusion

Learning evaluation is carried out by adequately integrating the APSI learning section and the objectives of the learning model in training students' digital entrepreneurship skills to improve 21st-century literacy skills. The research discussion follows the stages of research and development carried out in this study: define, design, develop and disseminate. This research and development have resulted in a valid, practical, and effective learning model called the Digital Entrepreneur learning model. From several analyses, the affective learning outcomes on each indicator showed an average result of 82.67 for the experimental class and 69.67 for the control class. It can be concluded that this digital entrepreneurship model can increase student motivation to become entrepreneurs with applications that they build themselves. The results showed that the digital entrepreneurship learning model was effective for students in higher education.

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