Tuijin Jishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 45 No. 3 (2024)

Developing Curiosity Based Project Learning Model

[1]Rizki Novendra, [2]Wakhinuddin, [2]Dedy Irfan, [1]Yogi Yunefri, [3]Adolf Bastian, [1]Nurliana Nasution

[1]Lecturer, Department of Computer Science, Lancang Kuning University

[2] Lecturer, Department of Automotive Engineering, Padang State University

[3] Lecturer, Department of Graduate Program, Lancang Kuning University

Abstract: This study aims to develop a learning model that can trigger or increase student curiosity. The design of this research stage uses ADDIE. The validity analysis was conducted by the validation of five validators on the construct aspect of Aiken's model 0849, the quality of the model content 0.803, lecture program unit 0.73, textbook 0.79, lecturer's guidebook 0.86, student guidebook 0.85 and research instrument 0.87. Practicality tests were conducted on lecturers and students resulting in scores of 89.3 and 86.1. The effectiveness test was measured in the cognitive, affective and psychomotor domains. The results of the effectiveness test on the cognitive domain obtained the results of the difference in learning outcomes between the experimental and control classes of 78 and 82. In the affective domain, students' curiosity was measured in four variables of pay attention, take notes, asking and comparing. All variables have a significance value <0.05. In the psychomotor domain, measurements were taken and the control class had an average score of 65 and the experimental class had a score of 88.28.

Key Words: Developing Learning Model, PJBL, Curiosity, ADDIE

Introduction

Indonesia is ranked 114th out of 191 in the world and 5th in SEA (*southeast Asia*) for the *Human Development Index* (HDI) ranking. At number one in the world is *Switzerland* and for *southeast Asia is* dominated by Singapore. The *Human Development Index* is an analogous measurement of the value of life dreams, learning, living standards related to poverty and well-being. [1]. Based on this data, it can be understood that the determining factor is Human Resources (HR).

The 21st century at this time seems to provide demands that always overshadow the world of education. The most pronounced demand is in terms of transition or transfer or change from manual skills to brain skills. The integration of literacy skills, insights, actions, and abilities to technology characterizes the way or learning process. [2]. The education process must be able to answer challenges related to preparing students to be able to plunge and work in the community. Given that at this time the type of work provides more demands, which initially there was a type of routine work that required low ability to complete it into creative work that requires a high level of skill [3]

The Asean Economic Community is also a demand as well as a challenge that must be taken seriously. In response to this, as capital to compete, graduates must have skills including *critical thinking and problem solving skills, communication skills*, *creativity and innovation skills, collaboration skills*. Some of these criteria are needed by graduates to be able to compete in the 21st century. [4]. Based on the demands previously described, it is known that universities are required to prepare competent graduates. In the process of preparing competent graduates, a good implementation process and *delivery system* are needed related to the learning and teaching process in the classroom. This intends to produce quality, competent graduates who are responsive to the needs of the workforce. Cycles like this should be developed and implemented continuously.

In addition, the learning paradigm of TVET (*Technology Vocational Education and Training*) in the 21st century is required to lead to innovative learning. [5]. The *Framework for 21st* century learning is divided into four components which include the learning environment, professional skills development, curriculum and instruction and assessment standards.

In carrying out this process, there is a problem of how to prepare students who are sensitive and have high curiosity in the learning process. Curiosity is one of the character aspects in the education process that must be developed in learning activities. Curiosity is defined as the willingness to explore [6] the unknown, meet new things, and accept uncertainty [7]. *Curiosity* is the basic thing that needs to be triggered and raised in the early learning process. Because in essence curiosity begins almost all beginnings "*Almost in the beginning was curiosity"* [8]. In teaching and learning activities, *curiosity* aims to develop the knowledge gained by students. The curiosity of students or students can be seen from the activeness in learning activities in the classroom. Learners who have high curiosity tend to ask questions frequently in the learning process, enthusiastic in finding answers to problems, paying attention to every object, enthusiastic about the process and every step of the activity [9]. Curiosity can be divided into three levels. In each level has several indicators which include elaboration of creative thinking skills, originality, fluency and flexibility related to explanations with logical reasons. The highest level of a learner's curiosity level is reached if all of these indicators are met. At the intermediate level, almost all indicators can be met, but there are shortcomings, namely in the originality indicator. While at the lower level, the originality indicator was also not obtained and deficiencies were found in the process of how to explain and solve problems with logical reasoning. [10]

Curiosity can also be defined as a disposition to ask questions, investigate or seek knowledge. As stated earlier, that curiosity is reflected in the activeness of students in the learning process. High curiosity is reflected when students ask a question. According to several references, curiosity is a characteristic that can arise if the learning activities apply a *project-based* learning model. [11]

Project-based learning is part of a learning model that builds on learning activities and the real world. The activity becomes a challenge for students related to daily life to be solved in groups. According to Goodman and Stivers (2010) in [12] a dynamic approach to teaching in which students learn problems and challenges, and improve 21st century skills while working on tasks in small collaborative groups.

Project-based learning exposes students to a concrete problem then students are required to find solutions and work on *projects* in a group. In the implementation process of the project-based learning model, according to [13] there are seven steps that are divided into three parts, namely skill competency *debriefing*, project work, and evaluation. The seven steps or what is called syntax include the formulation of expected learning outcomes, understanding the concept of teaching materials, skills training, project theme design, making project assignments and project report presentations. With these seven steps, it has an impact on increasing meaningful learning activities for students and providing real learning experiences and according to problems and needs.

From the above opinion, there is a correlation between project-based learning and *Curiosity*. By applying a project-based model in class action research through cycle one and two trials, it can increase character values in the aspect of curiosity. [14]. In addition, the application of project-based learning models according to [15] increases the character of curiosity epismetically and affects literacy skills.

It is undeniable that there are indications of curiosity in the project-based learning model. However, according to [16] curiosity in the *Project Based Learning* model is not optimal. Curiosity in the PjBL model will be optimal if it is emphasized on a certain basis. From some previous references, there is no detailed explanation regarding how to trigger curiosity, what kind of treatment can arouse curiosity, in which cycle or syntax in project-based learning can cause or trigger the awakening of curiosity and how to measure the curiosity of students.

According to D.E Berlyne in [17] Curiosity is a state of the organism induced by environmental situations rich in complexity, incongruity, doubt, difficulty, and similar conditions all characterized by the fact that they evoke a state of uncertainty and response conflict. The stimulated state can be observed as emotional tension and physiological and neurological arousal, primarily centered in the midbrain Reticular Activating System. Any environmental condition that contains a sufficiently high degree of uncertainty induces a state of tension in the organism that prompts it to explore its environment to reduce the tension. This tension is what is referred to as curiosity and the resulting behavior - exploration.

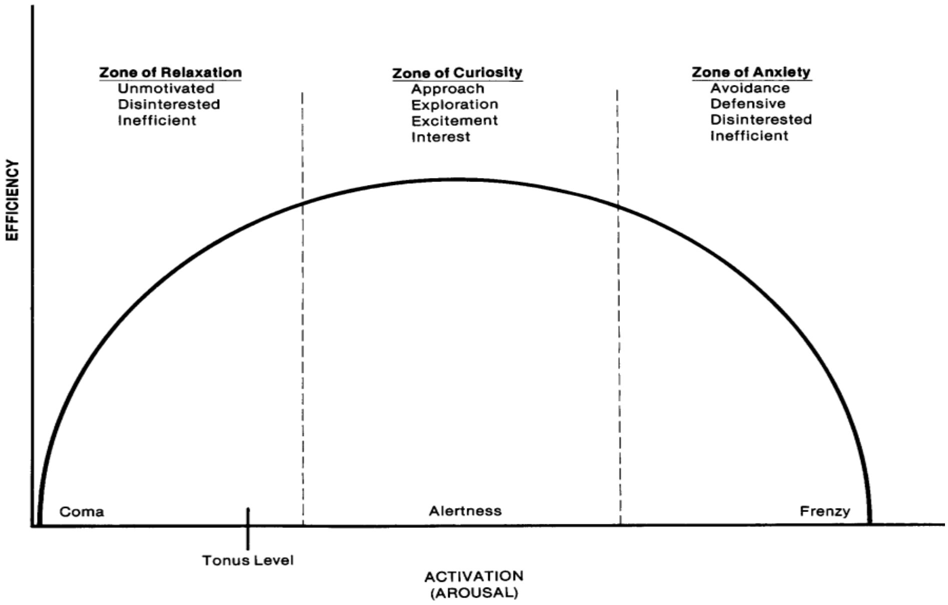

Figure 1 Effects on behavior and influence of changes in activation levels in an organism

In the course of information systems analysis and design or system *analysis and design* according to [18] *team work* or groups are very important in this course. Group work supports problem solving and impacts critical thinking, oral and written communication. Everything is found to be of primary importance. One of the learning outcomes of this course is that learners or students are able to design information systems. In the process of designing a system, students need to understand a business process. Based on a business process narrative that will later be converted or converted into a UML (*Unified Modeling Langguage*) diagram. Diagrams for modeling include (1) *usecase diagram, (*2) *activity diagram,* (3) *class diagram,* (4) *sequence diagram* to design (5) *user interface.*

ADSI or Information Systems Analysis and Design is a compulsory course in the *Information System* study program at the Faculty of Computer Science, Lancang Kuning University. Based on the results of the author's observations of lecturers of information systems engineering courses*, the* learning process still uses lecture, practice and assignment methods. In addition, ADSI is a difficult subject to learn because there are many challenges that must be faced by students. Students have difficulty understanding real-world problems in the context of OOAD (*object-based* design and analysis or *object oriented analysis and design*) and difficulty building an object-oriented model. [19]. Furthermore, there is no implementation of a learning model for this course, so students tend to be less motivated and the intensity of asking questions is minimal in the learning process. Based on the characteristics of the course. There is a need for a learning model that can help improve or develop in terms of communication, collaboration, creativity and critical thinking values or learning outcomes tend to decline.

Based on the identification of the above problems, efforts need to be made to develop a learning model that aims to create conducive learning by placing student-centered learning and lecturers serving as a facilitator in an effort to enrich the learning experience of students. The experience of learning is obtained through the participation of teaching participants or students in a direct way in a series of activities to study the area and interaction with the lesson module. Furthermore, students can construct the knowledge that has been obtained independently based on the learning experience they have gained.

As previously stated, observations, interviews and field studies have been conducted. It is necessary to conduct an in-depth study on improving learning outcomes, especially in ADSI courses in the Information Systems Study

Program. The development of the CBP learning model in ADSI courses is considered appropriate for implementation in education. There is no doubt that education, especially in the field of technology, can produce smart, work-ready and competitive workers. Therefore, research and development is an important and absolute thing to do. This research and development will produce a *Curiosity-Based Project Based Learning* (CBP) Model in ADSI courses with the aim of having an impact on quality and scientifically tested education. This learning model is applied to education that runs the Information Systems Study Program with graduates as S1 graduates.

Related works

Research conducted by [20] *Curiosity, creativity and engineering education*. Curiosity should be considered a prerequisite for creativity, as creative people are curious by nature. It has been stated that the need to know is the engine of discovery that motivates humanity to explore, experiment. In this article, the author discusses various opinions and definitions related to curiosity as a need to know, its relation to creativity and its implications for active learning models.

The case study discusses the role of curiosity and creativity in engineering design courses at the University of Windsor and the instructor's role in creating an engaging and stimulating teaching and learning environment that encourages curiosity, creativity, and intellectual agility. Keywords: Curiosity, creative teaching, teaching for creativity, creative process, motivation, engagement, engineering design 153. There is no doubt that inventiveness is the basis of people's energy which is very meaningful.

Research conducted by [21] *Project-Based Learning for the 21st Century: Skills for the Future*. Students drive their own learning through inquiry, and work collaboratively to learn and create blueprints that reflect their insights. From accumulating appropriate current technology skills, to becoming expert communicators and advanced problem solvers, students discover the value of this teaching approach. Introduction to Project-Based Learning Approach Project-Based Learning (PBL) is a student-driven and teacher-facilitated approach to learning.

The beginning of the project was Stephanie Bell, an elementary school teacher in Katonah, NY, and a doctoral student of Instructional Leadership at Western Connecticut State University, Danbury, CT. question. Students raise issues and are guided through research under teacher supervision. The results of PjBL are better description of a point, deeper learning, a large level library, and increased motivation to practice. Learners unpack problems by conceptualizing their own problems, designing their learning, organizing their research, and practicing many learning strategies.

Students thrive under this motivating, child-driven learning approach and acquire valuable expertise that will create a solid foundation for their future in the mainstream economy. In one UK study, over 3 years, students were taught using a conventional math program in one school and PBL in another. 3 times more PjBL students achieved the highest scores on national tests than students in conventional schools. The researchers formulated that students gain a different type of insight from using the PjBL approach.

Research conducted by [22] *Curiosity-based learning (CBL) program.* This model essentially results in a one-way pattern of knowledge transfer from instructor to student with the resulting effect of diminishing students' natural curiosity. When students are curious, they learn more about their world and as a result, are more closely connected to it. As a student, the author finds that traditional classrooms are not very engaging

As a student, the author fondly remembers his teacher responding as if greatly insulted when he asked a question in class. He suspected that the teacher must have viewed himself as a failed instructor if any student needed to ask a question about his presentation. This is in contrast to western classrooms where instructors routinely ask students questions. Then early on, as a new instructor, the author was disturbed by her students' disengagement and asked them about the qualities of their ideal teacher

Method

Development research is a form or procedure of research that is used to create a specific product and conduct tests on the success of the product. The steps of R&D, which consist of pursuing discovery research related to the product to be developed, developing the product based on the discovery, testing aspects in a setting where the conclusions will be used, and revising to correct deficiencies encountered in the step of carrying out testing.

Based on the research objectives that have been set, this research wants to get a *Curiosity-Based Project Based Learning* Model (CBP) in the ADSI course that is appropriate in order to increase expertise competence by stimulating the curiosity of Information Systems Study Program students. The development model carried out in this study uses a Research and Development approach called Research and Development (R&D).

Based on the opinions that have been put forward above, it can be concluded that the Research and *Development* method is a method used to produce a new model, new patterns, and new products in the form of design, development, and evaluation of products produced and testing their effectiveness through systematic steps. This Research and Development was conducted to develop a product in the form of a *Curiosity-Based Project Based Learning* (CBP) Model in the Information Systems Analysis and Design course.

Research Procedure

This research was carried out in the information systems research project of the Faculty of Computer Science, Lancang Kunning University. One of the efforts to improve the quality of learning by designing a learning model oriented to the system theory approach is the ADDIE approach model. [23]. One of the instructional designs widely used by learning professionals is the ADDIE (*Analyze, Design, Develop, Implement, Evaluate*) approach.

Product Trial

In this research, the development of the *Curiosity-based Project Based Learning* Model (CBP) was carried out after the design of the learning model was considered good by several experts in the *Focus Group Discussion* (FGD). There are two types of trials carried out, namely expert validation trials and field trials.

Data Analysis Technique

Validity Analysis: At this stage the data validation process is carried out by experts. The validity process is in the form of input provided by experts to become a benchmark for the development of the CBP learning model. Likert scale is used in the validity analysis process

Researchers analyzed the results of expert judgment using Aiken's V validity coefficient. "Aiken has formulated the Aiken's V formula to calculate the *Content Validity Coefficient* which is based on the assessment of a panel of n experts on an item regarding the extent to which the item represents the construct being measured. The assessment is carried out by giving a number between 1 (very unrepresentative or very irrelevant) to 5 (very representative or very relevant).

Practicality Analysis: Practicality analysis refers to the evaluation of the ease of use and applicability of a particular tool or method in a particular context. In the field of education, practicability analysis plays an important role in assessing the effectiveness and usability of various learning media and modules. Research studies have delved into the practicality analysis of different educational tools, such as the character-loaded card learning media

Effectiveness Analysis: Assessment of learning outcomes in the cognitive aspect generally assesses students' intellectual abilities which can be grouped into three categories: *Higher Order Thinking Levels, Middle Order Thinking Levels, and Lower Order Thinking Levels*. It consists of six levels revised based on Anderson's, namely: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating.

Cognitive aspect learning outcomes are used to measure the improvement of learning outcomes obtained by giving test questions to students before and after learning by using the CBP learning model in the form of *multiple choice* test questions that have been valid and reliable. Learning outcomes in cognitive aspects can also be measured from work products in learning activities carrying out project tasks carried out by students in several groups and assessing the products produced.

There are two forms of tests carried out in the learning evaluation of Advanced Machining Technology courses, namely the initial test (*pretest*) and the final test (*posttest*). Initial Knowledge Test (*Pretest*) is conducted before the learning material is delivered to determine the level of student understanding of the learning material and also as initial information in carrying out the learning process. The final Knowledge Test (*Posttest*) is carried out to measure the level of understanding or final knowledge that has been achieved by students after the learning process and to determine the level of learning outcomes that have been prepared previously and also as comparative information and measurement of learning success.

Result and discussion

Analysis Stage

Need *analysis* aims to make the model developed can answer basic and important needs in the learning process. Need analysis is very important to ensure that the teaching materials for the Information Systems Analysis and Design course received by students are relevant and in accordance with student needs, and ensure that the learning model developed is in accordance with content standards and process standards as well as the needs of lecturers in carrying out educational tasks.

The need analysis aspect in the questionnaire consists of 7 (seven) need criteria, namely; 1) lecture preparation; 2) lecture information; 3) learning implementation; 4) availability of teaching materials and application of learning models; 5) guidance in learning; 6) project work group assignments; and 7) assessment of learning outcomes. The processed data results in the form of respondents' achievement levels are presented in Table 4.1. Below:

Table 1. TCR Need Analysis of Students on Model Development

No.	Indicator	IDX	Criteria
1	Average Lecture Preparation	77,8	Good enough
2	Average Lecture Information	70,4	Good enough
3	Average Learning Implementation	53,1	Very Poor
4	Average Availability of Teaching Materials and Application of Learning Models	54,8	Less Good
5	Average Guidance in Learning	51,9	Very Poor
6	Group and Project Assignment Averages	60,2	Less Good
Average Learning Outcome Assessment		**58,6**	**Less Good**
Average Student Needs Analysis		**61,0**	**Less Good**

The average indicator of the need for initial preparation criteria for lectures with a response achievement rate (TCR) = 61.0%, and the category is not good so it is very necessary to develop a CBP model in the Information Systems Analysis and Design course.

Needs analysis is also carried out to lecturers teaching information systems analysis and design courses. The following are the results of the needs analysis in the TCR table

Table 2. TCR Need Analysis of Lecturers towards CBP Development

No.	Needs Analysis	Indicator	IDX	Criteria
	Lecturer Understanding			
1	Average Understanding of Lecturers		78,0	Good enough

2	Average Explanation of Learning Objectives	92,0	Very good
3	Averages of Materials and Learning Tools	68,0	Less Good
4	Average Interaction	96,0	Very good
5	Average Learning Model	49,6	Very Poor
6	Assessment Instrument Average	78,0	Good enough
	Average Need Analysis of Lecturer Needs	77,3	Good enough

Based on the level of response achievement (TCR) analysis of lecturer needs for the development of the CBP model above, it shows that the average TCR is 77.3%, which is in the Good Enough category. However, in the average section of the learning model, the results are very unfavorable. The conclusion of these results is that lecturers really need the development of the CBP model. The findings are also rational and essential for researchers to conduct research and development of the CBP model.

Design Stages

The main product in the development research is a curiousity-based project-based learning model in information systems analysis and design courses or in this study it is named the CBP model. In designing the PjBL-C model, important things to consider are: a) rationale; b) supporting theories and concepts; c) learning syntax; d) learning social system; e) management reaction principles that contain: (1) support system; and (2) instructional impact and accompanying impact of ADSI learning outcomes.

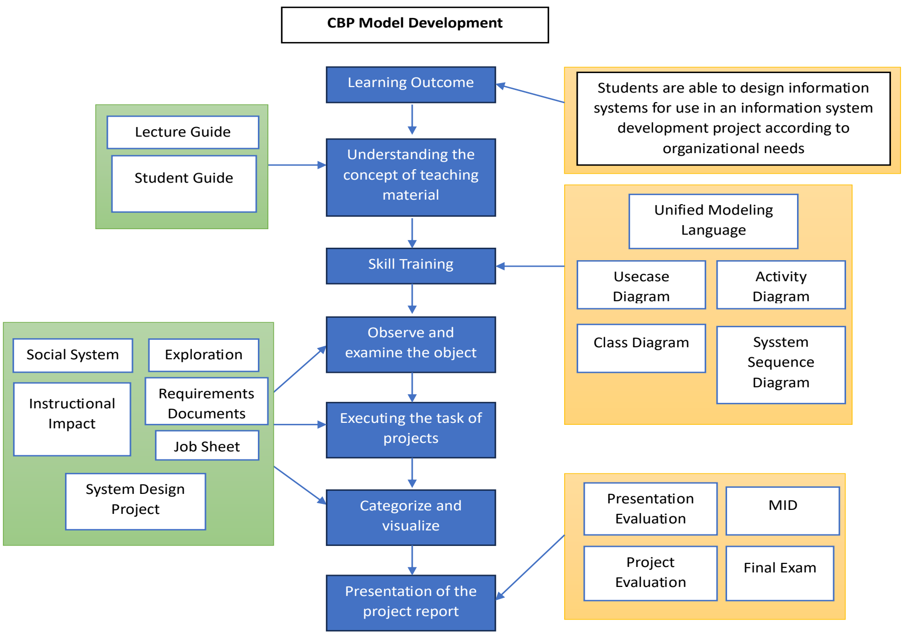

Figure 3. Hypothetical Model

Development Stages

The development of the CBP model was carried out after going through the stages of identifying problems that occur in the learning process, analyzing needs and designing learning models. Model development consists of several activities including evaluation of the CBP hypothetical model, validation of learning tools, and validation of research instruments by experts which are discussed in more detail at the implementation stage.

The hypothetical model formulated in this study was assessed to ensure efficient and effective implementation of the model. The discussion process was conducted with several experts in the field of Project Based Learning, learning evaluation, learning technology, vocational technology education, learning models, and linguists. The assessment was conducted through focus group discussion (FGD) sessions.

Based on the evaluation results, there are several important notes from FGD participants, namely: (1) Improvements to the test questions then the questions are included in the teaching module. (2) Improvements to the RPS to emphasize operational verbs. (3) Adding references or teri related to the relationship between PJBL and *Curiosity*. (4) In the evaluation process, do presentation assessment and project assessment. (5) There is a need to develop the syntax of the project-based learning model.

The results of the experts' inputs in the focus group discussion (FGD) activities became the basis for improving the model. In the improved model, the learning device validation process is explicitly described. Device products and supporting systems in the CBP learning model consist of: (1) Teaching module or textbook of Information System Analysis and Design (2) student guidebook (3) lecturer guidebook (4) CBP model book.

Figure 4 CBP Learning Model Products

In this CBP model assessment process using the Information Systems Analysis and Design learning evaluation guidelines. ADSI learning evaluation is carried out by combining the assessment of attendance, assignments, mid, and final exam by paying attention to the process of making information system design project assignments in ADSI learning produced by students. In general, the final results of the CBP model development are presented in Figure 6.

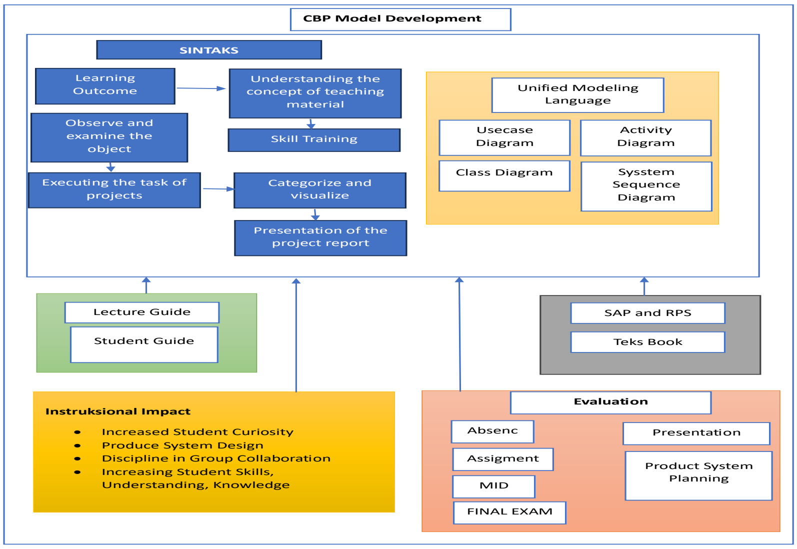

Figure 6 CBP Learning Model

Implementation Stage

Validity Analysis

Validity testing is carried out to obtain valid research products. Validity test data were obtained from the results of expert validators on all development products. The validity assessment was carried out by five validators on several aspects including the CBP model construct, model content, lecture program units, textbooks, lecturer guidebooks, student guidebooks and research instrument validation. The following are the results of the validity test in table 3 below

Table 3. Validity Test Results

No.	Validity Test Aspect	V	Description
1	Model Construct Validation	0,8497	Medium
2	Model Content Quality Validation	0,803	Medium
3	Validation of lecture program unit	0,73696	Medium
4	Textbook Validation	0,7991	Medium
5	Validation of Lecturer's Teaching Handbook	0,8668	Medium
6	Student Handbook Validation	0,8566	Medium
7	Validation of Research Instruments	0,875	Medium

Practicality Analysis

The practicality test of the CBP model was carried out after the validity instrument was validated by experts and the results were declared valid. The results of the practicality analysis of the CBP model can be seen from the results of the implementation of the CBP model which is carried out by conducting model trials in small and large scale groups. The following are the results of the practicality test in table 4

Table 4. Practicality Test Results

No.	Practicality Test Aspects	Percentage	Description
1	Results of Small Scale Practicality Trial by Lecturers	87,1	Very Practical
2	Expanded Scale Practicality Test by Lecturers	89,3	Very Practical
3	Small Scale Practicality Trial by Students	88,4	Very Practical
4	Large Scale Practicality Trial by Students	86,18	Very Practical

Effectiveness Analysis

The effectiveness of the CBP model can be known from student learning outcomes after using the CBP model in ADSI learning, or how the effect of using the CBP model as an independent variable on student learning outcomes in ADSI learning.

Data on student learning outcomes were obtained from *pre-test* and *posttest* results conducted in experimental and control classes. The test questions are in the form of multiple choice. *Pre-test* is a cognitive ability test given to students before ADSI learning. While the *posttest* was conducted after students received ADSI learning treatment using the model in the experimental class. The results of the *pre-test* and *posttest* can serve to measure the effectiveness of the learning model. In this effectiveness analysis will present the results of the analysis in descriptive form, normality and homogeneity tests and t-tests.

Table 5 T-test Results of *Pre-Test* Values of Control and Experimental Classes

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Nilai Pretest Kelas Kontrol	Equal variances assumed	.549	.462	-1.894	58	.063	-5.276	2.785	-10.850	.299
	Equal variances not assumed			-1.888	56.383	.064	-5.276	2.795	-10.873	.321

Based on the results of the *pre-test t*-test, the significant value (2- tailed) of both control and experimental classes is 0.063. This means that the significance value is greater than > 0.05. From this result, it can be concluded that there is no significant difference between the two classes, or it can be stated that both control and experimental classes have almost the same average ability, or the initial condition before being given treatment to the experimental class, students in both classes have almost the same academic ability.

Furthermore, the t-test was also conducted on the experimental and control *post-test* classes. This aims to find out whether there is a difference between the two classes in terms of learning outcomes. The results of the experimental and control class post-test t-test can be seen in table 6 below.

Table 6. T-test Results of *Post-Test* Values of Control and Experimental Classes

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Nilai Postest Kelas Eksperimen dan Kontrol	Equal variances assumed	.353	.555	3.127	58	.003	9.692	3.100	3.487	15.897
	Equal variances not assumed			3.138	57.922	.003	9.692	3.089	3.509	15.875

Based on the results of the *post-test t*-test, the significant value (2- tailed) of the two classes is 0.003. This means that the significance value is smaller than 0.05. This shows that the two classes, both control and experimental classes have different learning outcomes. From these results it can be stated that there is a significant difference between the learning outcomes of the control class and the experimental class at the end of learning. By applying the CBP learning model in the experimental class, the data shows that there is an increase in student learning outcomes compared to the control class.

Learning outcomes are also measured in the affective domain. The affective domain is a domain related to the values and attitudes of student character. Affective assessment can be in the form of interests, attitudes, self-concept, courtesy values, and morals or morals. The affective domain assessment of this study measures the level of student curiosity. According to [24] curiosity can be measured using several variables which include *pay attention, take notes asking and comparing*. Each of these variables has a measurement instrument. The instrument was filled in by control and experimental class students. The t-test is carried out to measure how each *independent* variable affects the *dependent* variable. The assumption used is that if the significance result is greater than > 0.05 then there is no significant difference between the experimental and control classes regarding student curiosity.

Table 7. T-test Results of Curiosity of Control and Experiment Class Students

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pay Atention	Equal variances assumed	33.663	.000	5.092	58	.000	1.201	.236	.729	1.674
	Equal variances not assumed			5.214	40.806	.000	1.201	.230	.736	1.667
Take Notes	Equal variances assumed	5.526	.022	2.631	58	.011	.583	.222	.139	1.026
	Equal variances not assumed			2.655	55.753	.010	.583	.220	.143	1.023
Asking	Equal variances assumed	7.893	.007	2.934	58	.005	.643	.219	.204	1.082
	Equal variances not assumed			2.969	53.646	.004	.643	.217	.209	1.077
Comparing	Equal variances assumed	18.128	.000	2.661	58	.010	.645	.242	.160	1.131
	Equal variances not assumed			2.699	51.275	.009	.645	.239	.165	1.125

Based on the table above, the sig (*2-tailed*) data or the significance of the four variables, namely *Pay Attention* 0.00. *Take Notes* 0.011. *Asking* 0.005 and *Comparing* 0.010. *Pay Attention* and *Asking* variables have a significance value <0.05. It can be concluded that there is a significant difference between the experimental and control classes. Experimental class students who were treated with the CBP learning model were more likely to pay attention during the learning process, record any information, ask questions and compare previously known information.

Evaluation Stage

Product revision aims to improve the product model developed, so that it is suitable for use in learning, and achieves the objectives that have been formulated. Based on the data findings from the implementation of the field trial and the responses given by students and lecturers, further information is used to revise the learning model. After that, the revised CBP model and its tools were tested again.

In general, suggestions for improvement in the development of the CBP model include:

a. The lecturer's guide has been improved and the stages for implementing the CBP learning model are more detailed.

b. The practice questions have been analyzed for validity, reliability, differentiation and difficulty level. Therefore, questions that did not meet the criteria were discarded.

c. Information Systems Analysis and Design teaching materials have been simplified to make it easier and more practical for students to learn.

d. In the process of assessing student projects and presentations, it is made in the form of an excel format so that it can make it easier for lecturers to evaluate learning.

Conclusion

Based on the results of research and discussion that refers to the objectives of this study, it can be concluded that the development of the CBP learning model consists of 7 syntaxes that are valid, practical, and effective so that it has clear comprehensive and strategic steps to be able to facilitate students so that they interpret the learning activities carried out, and have *learning experiences* that are able to construct new knowledge from previous knowledge. By applying the CBP learning model can increase student curiosity. This can be proven from the learning outcomes in the affective domain. Where there is a difference in the level of curiosity of control and experimental class students. The developed lecturer's teaching guidebook is assessed as valid by experts, assessed as practical by users and proven effective. This teaching guidebook can be used as a guide to improve the quality of learning that can provide opportunities for students to make observations The student guidebook developed was rated valid by experts, rated practical by users and proven effective. This guidebook makes it easier for students to carry out system development project assignments.

References

[1] R. T. Handalani, “Determinan Indeks Pembangunan Manusia Di Asia Tenggara,” *J. Kebijak. Pembang. Drh.*, vol. 2, no. 2, pp. 118–137, 2018.

[2] Y. Abidin and S. Iskandar, “Penerapan Pendidikan Karakter dengan Model Pembelajaran Berbasis Keterampilan Abad 21 Angga 1 , Yunus Abidin 2 , Sofyan Iskandar 3,” *Basicedu*, vol. 6, no. 1, pp. 1046–1054, 2022.

[3] K. B. Tamin, U. Ubadah, and S. Mashuri, “Tantangan Pendidikan dalam Era Abad 21,” *Pros. Kaji. Islam dan Integr. Ilmu di Era Soc. 5.0 (KIIIES 5.0) Pascasarj.*, vol. 1, pp. 338–342, 2022.

[4] I. Afriana and) Festiyed, “Pengembangan Assessment Autentik didasarkan LKPD Terintegrasi Literasi Digital Untuk Menilai Keterampilan Abad Ke-21,” *J. Penelit. dan Pembelajaran Fis.*, vol. 8, no. 1, pp. 90–99, 2022, [Online]. Available: http://ejournal.unp.ac.id/index.php/jppf/article/view/116565

[5] H. Windiyati, “Praksis Strategi Pembelajaran Kejuruan Bidang Agribisnis Abad 21,” *Taman Vokasi*, vol. 2, no. 2, p. 160, 2018, doi: 10.30738/jtvok.v5i2.2474.

[6] R. Novendra, D. Irfan, A. Bastian, Y. Yunefri, and N. Nasution, “IMPACT OF CURIOSITY IN LEARNING : A SYSTEMATIC LITERATURE REVIEW,” vol. 21, no. 06, pp. 673–693, doi: 10.5281/zenodo.11616356.

[7] S. Suhirman, S. Prayogi, and M. Asy’ari, “Problem-Based Learning with Character-Emphasis and Naturalist Intelligence: Examining Students Critical Thinking and Curiosity,” *Int. J. Instr.*, vol. 14, no. 2, pp. 217–232, 2021, doi: 10.29333/iji.2021.14213a.

[8] Ilhan Inan, *The Philosophy of Curiosity*. 2019.

[9] A. D. Evitasari and M. S. Aulia, “Media Diorama dan Keaktifan Belajar Peserta Didik dalam Pembelajaran IPA,” *J. Ris. Pendidik. Dasar*, vol. 3, no. 1, p. 1, 2022, doi: 10.30595/jrpd.v3i1.11013.

[10] D. Noor and K. Sari, “Application of Socrative-Based Assessment to Measure Mathematical Creative Thinking Ability with Problem Based Learning Model Viewed from Curiosity,” vol. 11, no. 2, pp. 137–147, 2022, doi: 10.15294/ujme.v11i2.59901.

[11] T. R. Rambe, “Penerapan model pembelajaran yang mampu untuk meningkatkan hasil belajar kimia dan karakter komunikatif serta rasa ingin tahu pada materi kimia larutan,” *J. Sintakis*, vol. 1, no. 1, p. 6, 2019.

[12] Ambiyar, “UPAYA PENINGKATAN HASIL BELAJAR SISWA MELALUI MODEL PEMBELAJARAN PROJECT BASED LEARNING DI SMK,” *J. Kependidikan*, vol. Vo4 No1, pp. 125–138, 2020, [Online]. Available: https://www.ptonline.com/articles/how-to-get-better-mfi-results

[13] N. Jalinus, R. A. Nabawi, and A. Mardin, “The Seven Steps of Project Based Learning Model to Enhance Productive Competences of Vocational Students,” vol. 102, no. Ictvt, pp. 251–256, 2017, doi: 10.2991/ictvt-17.2017.43.

[14] N. Nasution, Y. Darmayunata, and S. Wahyuni, “Augmented reality: as a guidance and counseling tool for early childhood,” *Proc. Siliwangi Annu. Int. Conf. Guid. Couns.*, vol. 1, no. December, pp. 103–107, 2022.N. Jalinus, R. A. Nabawi, and A. Mardin, “The Seven Steps of Project Based Learning Model to Enhance Productive Competences of Vocational Students,” vol. 102, no. Ictvt, pp. 251–256, 2017, doi: 10.2991/ictvt-17.2017.43.

[15] N. Nasution, Y. Darmayunata, S. Wahyuni, L. O. Liza, and D. D. B. Situmorang, “Positive impact of the COVID-19 pandemic: meaningful learning using augmented reality for children,” *J. Public Heal. (United Kingdom)*, vol. 45, no. 2, pp. E376–E377, 2023, doi: 10.1093/pubmed/fdac157.

[16] N. Nasution, Y. Darmayunata, and S. Wahyuni, “Information System Design for Monitoring and Evaluation of Learning on Blended Learning,” *AL-ISHLAH J. Pendidik.*, vol. 14, no. 2, pp. 1633–1644, 2022, doi: 10.35445/alishlah.v14i2.1368.

[17] N. Nasution, Y. Darmayunata, and S. Wahyuni, “Pengembangan Media Pembelajaran Anak Usia Dini berbasis Augmented Reality,” *J. Obs. J. Pendidik. Anak Usia Dini*, vol. 6, no. 6, pp. 6462–6468, 2022, doi: 10.31004/obsesi.v6i6.3408.

[18] P. Setiono, N. Yuliantini, and S. Dadi, “Meningkatkan Nilai Karakter Peserta Didik Melalui Penerapan Model Pembelajaran Project Based Learning,” *J. PGSD J. Ilm. Pendidik. Guru Sekol. Dasar*, vol. 13, no. 1, pp. 86–92, 2020, doi: 10.33369/pgsd.13.1.85-92.

[19] N. R. Faridah, E. N. Afifah, and S. Lailiyah, “Efektivitas Model Pembelajaran Project Based Learning Terhadap Kemampuan Literasi Numerasi dan Literasi Digital Peserta Didik Madrasah Ibtidaiyah,” *J. Basicedu*, vol. 6, no. 1, pp. 709–716, 2022, doi: 10.31004/basicedu.v6i1.2030.

[20] H. Noviyana, “Pengaruh Model Project Based Learning Terhadap,” *J. Edumath*, vol. 3, no. 2, pp. 110–117, 2017.

[21] H. I. Day, “Curiosity and the interested explorer,” *Perform. Instr.*, vol. 21, no. 4, pp. 19–22, 1982, doi: 10.1002/pfi.4170210410.

[22] B. N. Guidry and M. W. Totaro, “MIS students and the systems analysis and design course project: A proposed experiential approach,” *Int. J. Innov. Learn.*, vol. 13, no. 2, pp. 121–139, 2013, doi: 10.1504/IJIL.2013.052283.

[23] V. Y. Sien, “An investigation of difficulties experienced by students developing unified modelling language (UML) class and sequence diagrams,” *Comput. Sci. Educ.*, vol. 21, no. 4, pp. 317–342, 2011, doi: 10.1080/08993408.2011.630127.

[24] D. Pusca and D. O. Northwood, “Curiosity, creativity and engineering education,” *Glob. J. Eng. Educ.*, vol. 20, no. 3, pp. 152–158, 2018.

[25] S. Bell, “Project-Based Learning for the 21st Century: Skills for the Future,” *Clear. House A J. Educ. Strateg. Issues Ideas*, vol. 83, no. 2, pp. 39–43, 2010, doi: 10.1080/00098650903505415.

[26] B. Binson, “Curiosity-Based Learning (CBL) Program,” *US-China Educ. Rev.*, vol. 6, no. 12, pp. 13–22, 2009, [Online]. Available: http://libaccess.mcmaster.ca/login?url=http://search.proquest.com/docview/754908583?accountid=12347

[27] E. Widyastuti and Susiana, “Using the ADDIE model to develop learning material for actuarial mathematics,” *J. Phys. Conf. Ser.*, vol. 1188, no. 1, pp. 0–8, 2019, doi: 10.1088/1742-6596/1188/1/012052.

[28] Herwin and R. Nurhayati, “Measuring students’ curiosity character using confirmatory factor analysis,” *Eur. J. Educ. Res.*, vol. 10, no. 2, pp. 773–783, 2021, doi: 10.12973/EU-JER.10.2.773.