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Project-Based Learning Case Studied Model to Improving Learner Skills on Industry Revolution 4.0

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Abstrak

Saat ini terdapat kesenjangan dalam pembelajaran pemrograman visual yang belum optimal, dan belum mampu meningkatkan kompetensi abad ke-4. Penelitian ini bertujuan untuk mengembangkan model pembelajaran visual programming pada pendidikan kejuruan yang dapat meningkatkan kemampuan belajar siswa. Jenis penelitian ini adalah Research and Development yang mengacu pada model ADDIE. Subyek yang terlibat dalam uji coba terbatas model PJBL-CS adalah 15 dosen dan 25 mahasiswa. Subjek uji coba diperluas hingga mencakup 110 responden pada semester keempat program desain grafis. Pengumpulan data akan dilakukan dengan menggunakan kuesioner. Teknik analisis menggunakan uji Aiken'V, dan validitas menggunakan uji ahli dan Focus Group Discussion (FGD). Uji normalitas sebaran data dilakukan dengan menggunakan statistik Kolrnogorov Srnirnov. Hasil penelitian menunjukan model dan sistem pendukung, menurut para ahli, memenuhi standar validitas, didasarkan pada model penelitian dan pengembangan, dan dapat diterima untuk diterapkan. Model yang dibuat reliabel, mendapat rata-rata 86,67 poin dari dosen dan 86,00 poin dari mahasiswa. Penelitian telah menghasilkan Model Pembelajaran Berbasis Proyek Studi Kasus yang memberikan kesempatan kepada siswa untuk berpikir kritis, kreatif, berkolaborasi dan berkomunikasi dengan baik. yang dapat belajar kapan saja, dimana saja, membentuk mahasiswa untuk belajar secara mandiri, dan menciptakan pembelajaran yang terkoneksi antara mahasiswa dan dosen.

Kata Kunci: *Project-Based Learning, Studi Kasus, Kompetensi, Pendidikan Kejuruan*

Abstract

There is a gap in visual programming Learning that could be more optimal and has been unable to improve 4th- century competencies. This study aims to develop a visual programming Learning model in vocational education that can improve students' Learning abilities. This type of research is Research and Development, which refers to the ADDIE model. The subjects involved in the limited trial of the PJBL-CS model were 15 lecturers and 25 students. The trial subjects were expanded to include 110 respondents in the fourth semester of the graphic design program. Data collection will be carried out using a questionnaire. The analysis technique used the Aiken'V test, and the validity used the expert test and Focus Group Discussion (FGD). The normality test of the data distribution was carried out using Kolrnogorov Srnirnov statistics. According to experts, the result of the study is models, and support systems meet the validity standards, are based on research and development models, and are acceptable for implementation. The model that is made reliable, gets an average of 86.67 points from lecturers and 86.00 points from students. Research has produced a Case Study Project-Based Learning Model that provides opportunities for students to think critically and creatively, collaborate, and communicate well, which can learn anytime, anywhere, forming students to study independently and creating connected Learning between students and lecturers.

Keywords: Project-Based Learning, Case Studies, Competency, Vocational Education

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1. INTRODUCTION

The 21st century is the knowledge century, the age of knowledge-based economy, the century of information technology, globalization, the industrial revolution 4.0, and so on. In this century, changes occur very quickly and are difficult to predict in all aspects of life (Garba et al., 2015; Irwanto et al., 2018; Rahman, 2019). Human talents will shift away from manual and cognitive skills (brain skills) (Chong et al., 2019; Suryawati et al., 2020). Work

in 21st century involves acquiring, using, and evaluating data (Ningsih et al., 2019; Taar & Palojoki, 2022; Wangi et al., 2018). The work will involve various problems and require the ability to solve the problem itself, creative power, and a critical attitude to carry out multiple innovations and changes, as a challenge from high competitiveness in the business and industrial World (Irwanto et al., 2018; Kathy et al., 2022; Pheeraphan, 2013). Everyone in the digital era will use information communication technology to access and disseminate information, to interact with experts and the communities they use, including Learning communities that are useful for solving all educational problems they face.

In Indonesia, science and technology development is significant, marked by progress in various vitalsectors. The development of science and technology is increasingly advanced and developing (Englund et al., 2017; Jaya Saragih et al., 2020; Sulisworo et al., 2020). Even its existence cannot be separated from daily human activities in survival. Each country must respond to these developments holistically and integrate them to transform the challenges of industry 4.0 into possibilities (Roll, 2021; Skobelev & Borovik, 2017). This challenge must be answered by improving the quality of Learning and curriculum owned by existing universities and schools. They were considering the needs of every graduate proficient in the field they are involved in and having the character or soft skills to respond to the challenges posed in progress and conditions in the digital era 21st century (Bravo et al., 2021; Wangi et al., 2018). The advancement of twenty-first-century technology requires that each individual has the necessary skills or abilities, both hard and soft, to enter the World of Work and compete with the resources of other countries. The essential skills for the twenty-first century are Learning and innovation, information skills, media and technology skills, and life and career skills. This is consistent with the National Education Association's position. The changes that have occurred are very radical through the challenges and obstacles that overturn the existing systems and challenges that are considered to be already established and replace them with a new system.

Visual programming language mastery competence is still highly regarded in the World (Mondro et al., 2020; Psycharis & Kallia, 2017). The need for programmers in the World is beneficial in IT, so graduates must have a considerable opportunity between professional computer skills, especially programmer needs. However, the survey was conducted in 3500 organizations in North America and Europe, and Asia is dominated by the need for IT security professionals to occupy the top ranking and become a point of reference requiring distant professionals with available requirements (Bolanakis, 2019). The above is very important for programmers to close the gap by meeting the needs of the IT professional field so that they get reliable resources. Nowadays, programmers and IT problems have become a trend (Bice et al., 2018; Grollmann, 2008). Based on the above opinion, computer programming Learning is not easy to understand and learn, so students do not meet the expected competencies.

The PjBL model is innovative Learning that can be applied to practical Learning with a focus on students where students are allowed to independently develop cognitive, affective, and psychomotor abilities that are integrated into project assignments derived from real-world problems by with the curriculum, and Learning is carried out according to directions. by placing lecturers as motivators, consultants and facilitators (Afriana et al., 2016; Izzah et al., 2021; Wakid et al., 2020). This is in line with the goal of vocational education, which wants its graduates to face the world's demands on the education system to prepare students with 21^{st}-century competencies to face more complex challenges both now and in the future.

The results of observations made by researchers found inaccuracies in the use of Learning models that occurred at this time. Lecturer-centered Learning was considered inappropriate in current visual programming courses to improve Learning outcomes (Huang et al., 2019; Zubaedi et al., 2021). The lecture method that emphasizes understanding

concepts or theories causes boredom and could be more attractive. Developing Project-based Learning can improve student Learning outcomes than the lecture method, which emphasizes understanding concepts or theories, causing boredom and less interest (Jalinus et al., 2019; Saputra & Sujarwanta, 2021; Syakur et al., 2020). The students' creativity is not visible, and the experience they gain from the Learning process yet to been able to build critical thinking skills (Afdareza et al., 2020; Rahman, 2019; Thompson, 2011).

Development of the Project-Based Learning model based on a Case Study is essential to overcome students' critical thinking skills and positively influences students from student achievement and thinking skills (Mahardika et al., 2017; Mulyono & Agustin, 2020; Mustapha et al., 2020). Critical thinking is one of the skills students need to develop and succeed in the global economic era, in addition to creativity, innovation, problem-solving, communication, and collaboration. Project-Based Learning based on Case Studies is valuable for increasing students' knowledge and critical thinking skills and can also support problem-solving, group work and communication skills (Mutakinati et al., 2018; Nilsook et al., 2021). This case study method will significantly help students understand visual programming courses because it is conditioned by an attractive Learning atmosphere by providing compelling and appropriate cases.

The development of a visual programming Learning model is one of the efforts to solve Learning problems. Meanwhile, based on observations in the field of Learning visual programming courses in the graphic design department, there are no alternative Learning media explicitly designed for the Learning process. Therefore, designing and developing a case study-based project-based Learning model for visual programming courses, presenting teaching materials, practice questions and correspondence facilities are necessary. This development aims to create a new Learning model and alternative Learning resources.

2. METHODS

The type of research used in this research is R&D (Research and Development). The Development of a Case Study-Based Project-Based Learning Model (PJBL-CS) is a term that relates to the ADDIE model's Learning design, which consists of five stages (Analysis, Design, Development, Implementation, and Evaluation) (Marji, 2020). The procedure for developing this research also refers to an instructional design. Instructional design is an iterative process of planning performance goals, selecting Learning strategies, selecting media, selecting or creating materials, and evaluating. The stage of Development of the "PjBL-CS" Model is shown in Figure 1.

Figure 1. Stage of Development of the "PjBL-CS" Model

The research procedure for developing of the Project-based Learning model based on Case Studies in vocational education follows the sequence of activities in the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). Efforts to design the

development of Learning models and test the effectiveness of the Learning model to be developed this research will be carried out in 3 stages: Phase I descriptive research, namely conducting needs analysis and model design (product design). Phase II is development research with validity and practicality tests, and Phase III will conduct model testing and evaluation.

In Phase I, a needs analysis will be carrying, namely carrying out an analysis of the current state of Learning and competency skills and then comparing it with the expected conditions. The discrepancy (discrepancy) between the current and the expected conditions is used as a Learning problem that will be resolved. Diploma program students and lecturer will carry out data collection. A data collection method in the form of a questionnaire. Quantitative data was analyzed using descriptive statistics and inferential statistics. Inferential statistics uses a different test with a t-test to see the difference between expectations and current achievement conditions. The results of the discussion and discussion will provide recommendations for Learning models that can improve the competence of vocational education graduates. At this stage, a Project Based Learning Learning model will be designed based on a Visual Programming case study and also a Focus Group Discussion (FGD).

Phase II is the model development stage, namely by validating the product that has been designed, through the process of testing the validity of the model and testing the practicality of the model, the method used can be in the form of expert validity and also Focus Group Discussion (FGD). This is done repeatedly until the product can be declared valid and practical, so it is feasible to use.

In Phase III, a Project Based Learning Learning model based on a case study of visual programming will be conducted in the Vocational Education Diploma III Graphic Design. A limited trial will be conducted in one Diploma III study program. Then the model test will be expanded to see the model's effectiveness compared to the ordinary PjBL Learning model. Effectiveness will be seen from the point of achievement of competencies, namely the ability to think creatively, think critically, dare to make decisions, cooperate, and solve problem. The instrument for measuring the results of the Learning model treatment will be processed with the appropriate statistics using the LISREL program.

3. RESULTS AND DISCUSSION

Result

The results of the research developing of a Case Study-based Project Based Learning model in the Visual Programming class, were carried out using the ADDIE research design. This development design has five steps: analysis, development, implementation, and evaluation. Need analysis is done to obtain data in the form of information about needs and expectations in visual programming Learning. Based on the need analysis, several things must be developed in Learning visual programming, as shown in Figure 2.

Based on Figure 2 shown that Learning objectives are 10%, Learning models' development is 20%, aspects of Learning methods are 16%, aspects of teaching materials are 20%, and Learning media are 20%. Aspects of Learning evaluation are 26%. The demand analysis also identified priorities/needs for academics who want to improve 21st-century skills like critical thinking, communication, cooperation, and creativity. The needs analysis stage examines the existing state of computer network Learning and the demands of students and lecturers. This stage discussed the disconnect between current affairs and student priorities/needs regarding 21st-century competencies and expected Learning in higher education.

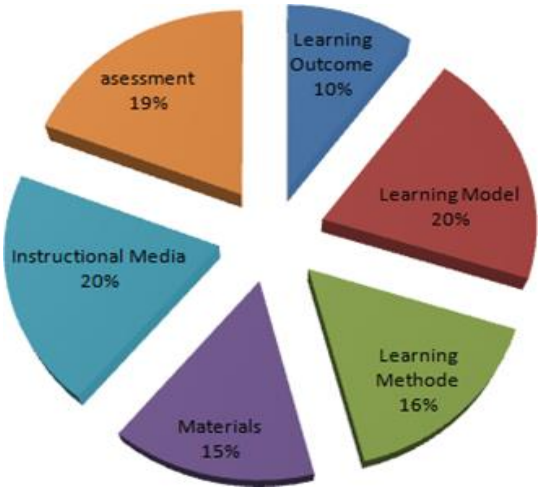

Figure 2. Visual Programming Learning Components that Need to be Developed

In the needs analysis stage, the current state of Learning and skill competencies is also carried out and compared with the expected conditions. The discrepancy (discrepancy) between the present and joint disorders is used as a Learning problem that will find a way out. Diploma program students and lecturers will carry out data collection. Q&A was done using a questionnaire, and inferential statistics were used to analyze quantitative data. Inferential statistics use the t-test to compare expected and actual achievement levels. In the opinion lecturers, PBM competency achievements are shown in Figure 3.

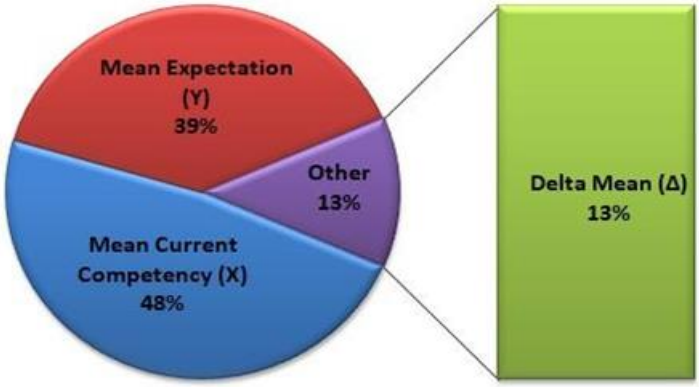

Figure 3. PBM Competency Achievements in the Opinion of Lecturers

Based on Figure 3, the results of the data analysis indicate that the Teaching and Learning Process (PBM) of vocational students enrolled in the Graphic Design Study Program at Medan Creative Media State Polytechnic is effective. According to the professors, the current state has only reached an average of 70.37, indicating that it remains in the excellent category. The results of the demand analysis suggest that students and lecturers require a model for developing project-based Learning based on case studies in courses on visual programming. The findings and analysis are incredibly sensible and critical in reinforcing researchers' willingness to undertake research and construct PjBL models based on Case Studies.

Model Validity

Validation is a measurement process for the accuracy or accuracy of an instrument in measuring the variables or indicators that you want to measure. After conducting a Focus Group Discussion (FGD), research and data collection (data collecting) were carried out to test the Project-Based Learning model based on the Case Study based on whether the product was valid or invalid. This study was conducted to measure the validity of the product model, among others, the fact of the developed model syntax and the reality of the product content of the developed model. The measurement of these two things uses measurement instruments carried out by a team of experts/experts in their respective fields, including Learning model experts, project field experts, language experts, technology and vocational experts, and research and development experts.

The construct validity test of the Project-Based Learning Model Based on a Case Study is carried out by experts who can do so by the established requirements. The construct validity of the model's syntax is not quantifiable. As a result, the measurement model uses LISREL software version 8.80, also known as Confirmatory Factor Analysis (CFA), which demonstrates the operationalization of variables or study constructs into quantifiable indicators expressed as equations or a specific path diagram. Based on statistical data processing with LISREL software version 8.80 and Stevens' proposal. A model is declared valid or fit (goodness-of-fit models) if it meets the following criteria: The Chi-Square value is not zero, and the P-value is more significant than 0.05 (>0). Experts (validators) validate nine total indicators according to their respective fields. The results of the assessment of each validator (expert team) on the contents of the product-based project Based.

The statistical validation contents Project-Based Learning model book using an Aikens'V value of 0.87 with an Aikens'V assessment range of 0.60 1.00. Therefore, the validation results from the expert team are categorized as valid. For example, the model syntax, social system, reaction principle, supporting impact, instructional and accompanying effect are all evaluated for construct validity. The LISREL model fit index can be used to assess the entire model. The Chi-Square value is expected to be non-significant (p-value > 0.05) because the model and are equivalent. Additionally, we meet the interpretation of the Loading factor based on these data. The loading factor is the correlation between an indicator and its latent component. The reference weight factor of 0.50 or more is considered vital enough validation to explain the latent construct. The construct syntax of the case study-based project-based Learning model is validated in Figure 4.

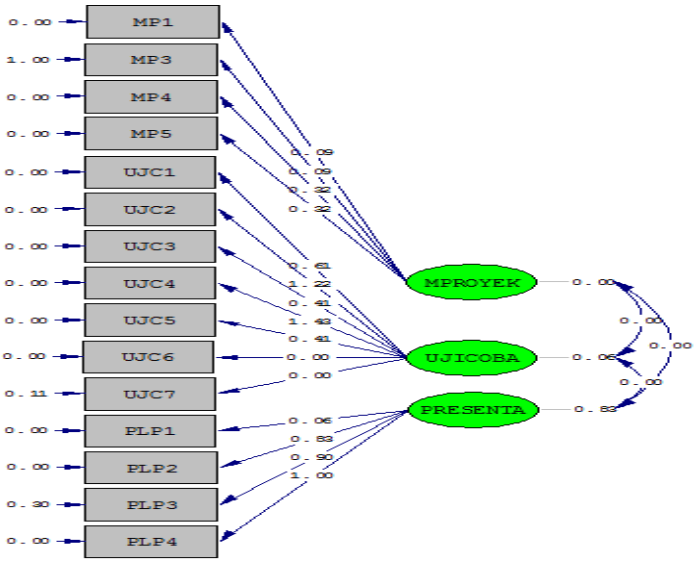

Figure 4. Confirmatory Factor Analysis Model Syntax

Figure 4 consists of case study syntax and identification where the case study syntax shows that the questions from (CS1-CS10) while the identification syntax questions consist of questions (ID1-ID7) indicate that four items do not meet the standardized Loading Factor >0,5, namely ID1, ID2, ID3, and ID4. After the compatibility test, the results, namely Confirmamatory Factor Analysis, syntax 1 and 2, stated Chi-Square results = 88.53, with P-Value = 0.98039, while RSMEA = 0.000. The data analysis shows that the validation of the syntax construct of the Project-Based Learning model based on the Case Study meets the criteria of goodness-of-fit models so that the value of the construct validity of the syntax can be grouped or classified as valid or fit.

Practicality

The practicality test of the model involved five lecturers of visual programming courses in the Diploma III Graphic Design program at the Medan Creative Media State Polytechnic. A practicality test is an activity used to measure the level of practicality of each element or product that has been declared valid or goodness-fit models.

This study tested several products based on responses from lecturers and students. These practicalities include the Practical Test of Case Study-based Project Based Learning Model Books, Practical Test of Lecturer Manual Books, and Case Study Based Project-Based Learning Model Teaching Module Books in Visual Programming Courses Student Decisions.

The practical test of the Project-Based Learning model based the Case Study is based on the lecturer's assessment of attractiveness, development process, user convenience, functionality, usability, and reliability with an average value of 91.3. Conversion of quantitative data to qualitative data, is included in the Very Practical category. The practicality test is based on the lecturer's assessment of the aspects of material organization, writing format, language use, content aspects, and evaluation system, with an average score of 92.0. Converting quantitative data to qualitative data, is included in the Very Practical category. The results of the practicality test were based of the lecturer's assessment of aspects of writing format, language use, introduction, content aspects, and evaluation system, with an average score of 89.7. Converting quantitative data to qualitative data, is included in the Very Practical category.

Student assessment in measuring the practicality of student manuals is the same as in the practicality test of lecturer decisions, namely in writing format, language use, introduction, content, and evaluation system aspects, with a total of 17 indicators. Based on the practicality test by students related to the Case Study-based Project Based Learning Student Guidebook with an average value of 85.2, it is declared Practical.

Effectiveness

The expanded trial process is a process that is carried out after the limited trial process is declared effective. The respondents were taken from students who took the Visual Programming course. Students for the expanded test were groups A, B, C, and D, with respondents as many as 110 students of the fourth-semester graphic design program. The number of students was taken randomly to form a homogeneous group by conducting a pre-test. The results were then reduced to 1 homogeneous group randomly randomized, namely the experimental group. Then, practice data was collected for the group. This data will be used as the basis for determining the effectiveness of the Case Study-based Project Based Learning model for the experimental class. Before testing the effectiveness of the practical course, pre-test and post-test were also tested in the control class.

The data analysis revealed an increase in student Learning scores because of the implementation of the Case Study-based Project-Based Learning approach. It raises the

perceived value of student Learning outcomes, as evidenced by the average (mean) score at the start of the lecture when the pre-test was administered vs. The standard (mean) score of students after the post-test. Figure 5 is a histogram of the difference between the average values of the initial and final values in the experimental class.

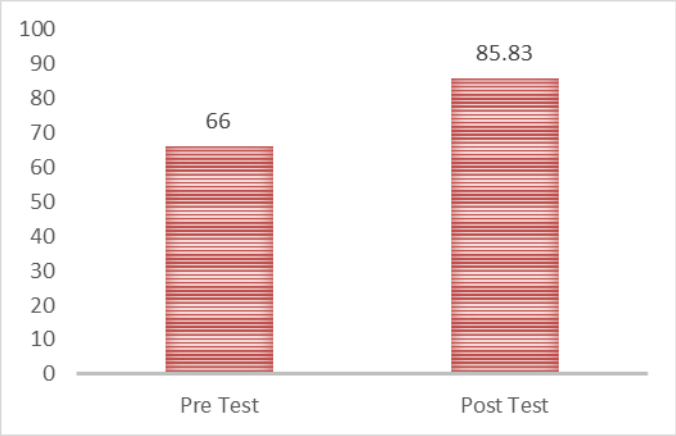

Figure 5 Histogram of Improvement in Pre-Test and Post-Test Learning Outcomes

Based on Figure 5, showing the data shown in tables and histograms relating to student Learning outcomes, it is possible to conclude that the Case Study Based Project Based Learning model is "successful" in improving student Learning outcomes. Particularly in Visual Programming classes, it has been considered a new Learning model for revitalizing vocational education.

Discussions

Based on the results of the analysis and input from the focus group discussion, it is necessary to develop a Learning model that can accommodate the demands of industry and the world of work. This is in line with expert thinking related to 21st-century competencies so that later students will have skills, be able to solve problems, can think critically, learn to use technology that by with the era of the industrial revolution 4.0 who can learn flexibly, which can be arranged online and offline (Fatimah & Santiana, 2017; Gandasari et al., 2020). One of the Learning models considered relevant to current Learning and which can answer the problems that occur, the researchers offer the development of the Project-Based Learning Case Study Model.

This research and development have resulted in the PjBL Model - Case Study of Visual Programming and its support system in the form of model books, modules, and guidebooks that are valid, practical, and effective. The PjBL-Case Study model provides opportunities for students to think creatively and innovatively, be able to solve problems, and dare to make decisions. This is in line with the results of previous research, which states that innovative Learning models such as PJBL CS can be applied to practical Learning d with a focus on students where students are allowed y to independently develop cognitive, affective, and psychomotor abilities that are integrated into the task (Bystrova, 2020).

Based on the analysis of students' abilities (problem-solving abilities and decision-making abilities), the applying the Case Study-based Project-Based Learning Model is better than conventional Learning. The Case Study-Project-Based Learning Model can facilitate the development of students' problem-solving skills and decision-making abilities at the Diploma III Graphic Design education level, meaning that using Case Study-based Project-Based Learning Models can help students be more active, creative, and independent in Learning. This is according to the results of research where in PJBL-CS, students identify real problems

in the field, try to raise several important questions that have an impact on project making with Case Study activities, then try to formulate strategies (alternative) problem-solving with project work (Mutakinati et al., 2018).

Achievement of impact and PJBL-CS model system, includes social systems such as lecturers as facilitators, moderators, and motivators, a mutual collaboration between students, feedback between lecturers and students. For the reaction system, such as being stimulated through notifications, response reactions through interactions from forums and chats, ratings, and feedback. The support system includes modules, Models, Guidelines, and supporting applications. The instructional impact obtained includes analyzing, solving problems and making products. The accompaniment effects obtained include students being able to think critically, solve problem, be flexible, learn anytime, and anywhere form students to study independently, and create connected students and lecturers.

This implication provides an overview of applying of the project-based Learning case study model to improving learner skills, especially in the visual programming course. This research will be beneficial, especially for programming teachers, as a reference in implementing Project-Based Learning in the classroom. This research still has some limitations. One of them is the limited scope of the study, where this study only involved subjects in one school. Further research will be able to deepen further and broaden the scope of research related to the topic of Project-Based Learning.

4. CONCLUSION

According to the research findings, the created Case Study-based Project-Based Learning Model demonstrates applicability and accuracy. The Project-Based Learning approach based on Case Study is applicable as a model for Learning visual programming practice and other subjects with similar qualities. This Case-based Project-based Learning model produces four new products practically used in Visual Programming Learning. The product's practicality is known from the practicality test process to users. The new products include of model books, teaching material books, lecturer manuals, and student manuals. The model developed with the Case study strategy is an essential stage of the PjBL-Case Study model, having the feasibility of being more effective in improving Learning outcomes compared to other (conventional) models. The PjBL-Case Study model, with this new strategy, can guide students to learn with higher-order thinking skills so that the Learning outcomes of the PjBL-Case Study model are more effective than conventional models. The accompaniment impact obtained is that students can think critically and creatively, collaborate communicate well, and learn anytime anywhere, forming students to study independently and creating connected Learning between students and lecturers.

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