

# The Effectiveness Of The Problem Based Flipped Classroom Learning Model In Programming Algorithm Courses

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**Abstract:** This study aims to develop a problem based flipped classroom learning model in the programming algorithm course. Based on a preliminary study and needs analysis that has been carried out in the programming algorithm course, where there are findings of learning outcomes and the ability to understand programming logic which is still low in students, so it is necessary to develop learning models that are relevant to the current pandemic and industrial revolution 4.0 conditions. The research and development method used is Research and Development, where the method for instructional development applies the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). With the student center learning system, the problem-based flipped classroom learning model can improve students' 4C competencies (creativity, critical thinking, communication and collaboration) and can improve the literacy culture of students and lecturers. The implementation of this learning model can improve learning outcomes in programming algorithm courses. There was a change in the attitude of both students and educators in achieving learning objectives.

**Keywords:** Problem based flipped classroom model, programming algorithm.

## Introduction

The COVID-19 pandemic indirectly has a very significant impact on aspects of human life, especially in the education aspect. Every role holder in education, whether teachers, students, parents, must be ready to carry out the 4.0 revolution where learning is carried out online. One of the changes is the application of applications that can make it easier for teachers in the assessment system or learning assessment which is usually carried out in class using paper, replaced by using sophisticated applications that can be downloaded for free on the internet. The use of the application in question is google form. This application aims to make it easier for teachers to assess learning evaluation (Muzdaliifah et al., 2021)

The quality of education in the 4.0 era in the midst of the Covid-19 outbreak is a challenge that really requires solutions that are in accordance with the needs and expectations of the community. Requires educators, especially teachers and

education observers to find ways to face the 4.0 era in the midst of the covid-19 outbreak. Teachers must improve and maintain ways of working and find new methods or ways to face future challenges. The method used is that teachers need to be more creative in the learning process by applying methods or ways of critical thinking, creativity, communication skills, cooperation, socio-society, and character education in particular. (Akmal & Santaria, 2020).

With the Work from Home (WFH) policy, it is able to force and accelerate teachers and students to master digital learning technology as a necessity. Various distance learning media were tried and used. Facilities that can be used as online learning media include e-learning, zoom application, google classroom, YouTube, and whatsapp social media. These facilities can be used optimally, as a medium in carrying out learning such as in class. With these online media, indirectly the ability to use and access technology is increasingly controlled by students and teachers (Siahaan, 2020)

When the Covid-19 disaster hit the world, it had an impact on changing the model or pattern of learning at universities in Indonesia, which at first turned offline into an online learning process. A study in Fasilkom Unilak, aims to analyze the effectiveness of online learning during the Covid-19 pandemic. The results found that the effectiveness measured was related to the applications used, the content in the learning, the devices used, the time used, the costs used, the interaction between students and lecturers. The form of the variable is a single variable. Using a questionnaire with 26 questions. The object of this research is 63 students of the 2018 and 2019 batches who are active and take part in online learning. After measurement, all variables used were declared valid and reliable. Of the 6 indicators of effectiveness measured using the percentage formula, the results obtained for all indicators are said to be effective. The determined effective limit is 50%. The results of the indicator measurement, all of them have a value of more than 50%. Based on the measurement results, it is stated that online learning during the covid-19 pandemic at the Faculty of Computer Science, Lancang Kuning University is said to be effective with an average measurement result of above 50% (Djususar, Sadar, et al., 2021).

Educators must be able to master various online learning facilities, in order to create ideas about more varied learning methods and models that have never been done by educators. For example, teachers create creative video content as teaching materials. In this case, the teacher is more persuasive because it makes students more interested in the material provided by the teacher through the creative video. Students can understand what the teacher explains through creative videos made by the teacher. So that with the application of this home learning model, students do not feel bored in participating in online learning (Siahaan, 2020)

Advances and developments in technology allow automation in almost all fields. New technologies and approaches that combine the physical, digital and biological worlds will fundamentally change the way people live and interact (Tjandrawinata, 2016), as well as in the world of education which is very dynamic in nature, namely the curriculum

and the learning process must be in line with the development of information technology known as the industrial era 4.0 as part of the technological revolution that will change the way human activities are in scale, scope, complexity, and transformation. From previous life experiences. In the world of education in the era of the industrial revolution 4.0, it can be seen from two different perspectives, including this era can be seen as an opportunity, and can also be seen as a threat.

The flipped classroom method is an innovative pedagogical approach that focuses on learner-centered teaching by reversing the traditional classroom learning system that has been carried out by teachers. (Bergmann & Sam, 2012). This flipped classroom method has many benefits (McLaughlin et al, 2014), such as students will have positive opinions and be open to new knowledge, be more active, more independent and creative and more critical in addressing certain case problems.

Flipped Classrooms a form of blended learning (through face-to-face and virtual/online interactions) that combines synchronous learning with asynchronous independent learning. Synchronous learning usually occurs in real time in the classroom. Learners interact with a teacher and classmates and receive feedback at the same time. Meanwhile, asynchronous learning is learning that is more independent. Content is typically accessed through some form of media on a digital platform. Students can choose when they study and also they can ask questions in the comments column, and share their ideas or understanding of a material with the teacher or classmates. Meanwhile, feedback will be received by them not at the same time.

Video is a medium that is often used as input for self-study because it is accessible and allows students to stop and re-watch content as needed. Text and audio can also be used as content to deliver material and ensure students are fully prepared for synchronous classes. The following is an illustration of the concept of implementing the flipped classroom.



### Flipped Classroom Method Concept

The flipped classroom method is divided into three activities, namely, before class starts (pre-class), when class starts (in-class) and after class ends (out of class). Before the class begins, students have studied the material to be discussed, at this stage the abilities that are expected to be possessed by students are remembering and understanding the material. Thus, when the class starts, students can apply and analyze the material through various interactive activities in the classroom, which are then followed by evaluating and working on certain project-based tasks as activities after the class ends (creating).

### Method

From the purpose of this research, it is illustrated that the method or approach that will be used in this research is in the form of research and development. According to (Gall et al., 2003) Research and development in education is a process for developing and validating products. In addition, it can also discover new knowledge and or answer specific questions regarding practical problems. The use of the word product in educational terms implies the meaning that in the development of the field of education it does not only produce textbooks or learning support tools. But it also produces processes, learning procedures.

According to Borg and Gall, educational research and development is a process used to develop and validate educational products, meaning that research and development is a process used to develop and validate educational products. The results of development research are not only the development of an existing product but also to find knowledge or answers to practical problems. Sugiyono (2009) argues that research and development methods are research methods used to produce certain products, and test the effectiveness of these products. To be able to

produce certain products, research that is needs analysis is used (survey or qualitative methods are used) and to test the effectiveness of these products so that they can function in the wider community, (Sumarni, 2019)

The development procedure used as a reference in this research is the ADDIE Model. This model is arranged systematically using the development stages, namely analysis, design, development, implementation and evaluation, which is abbreviated as ADDIE (Dick, Carey & Carey, 2001). The ADDIE model was taken as an option for developing learning designs with consideration and comparison of several other instructional development models such as ASSURE, Borg and Gall, and others.

The ADDIE instructional design process (ie, Analysis, Design, Development, Implementation, and Evaluation) is a general approach widely used in the development of instructional courses and training programs. This approach provides educators with useful and clear steps for effective instruction. Consisting of five phases, the ADDIE framework is used in two ways in the development of an instructional design course for Masters level students. First, the ADDIE framework is used in the planning of an instructional design course. Furthermore, the framework proves useful as a scaffold for developing students multimedia project as their peak requirement for the course. Using the ADDIE model throughout the course puts an emphasis on the learner rather than the teacher-centred approach. Learner analysis is an important aspect of course design and an important part for students as they design their individual multimedia projects.

Effectiveness is another important consideration in analyzing authentic judgments. According to Braskamp & Engberg (2014) effective assessment must have criteria, namely, have clear objectives and readiness for assessment, involve stakeholders during the assessment process, teachers must know about what they will assess and how they will assess it. In addition, an effective assessment is an assessment that considers the influence of the assessment on student behavior and learning outcomes, aligns with learning outcomes and curriculum, provides and explains the assessment structure for student learning, and provides feedback afterwards (Kadir, et al, 2019). In the

category development research, it is declared effective to contain (1) learning outcomes; (2) Attitude, and (3) skill/psychomotor.

Assessment of the effectiveness of the problem-based flipped classroom model developed is a measure related to the success rate of a learning process. Effectiveness measurement learning model problem based flipped classroom in programming algorithm courses through measurement cognitive, affective and psychomotor. However, before that, the instrument was compiled by making a grid of questions, compiling test questions and assessments. The questions are in the form of multiple-choice objective tests to be given during the pre-test and post-test. However, the test of the instrument was carried out by testing questions to analyze the validity, reliability, level of difficulty of the questions, and the discriminating power of the questions.

Data on effectiveness model problem based flipped classroom in the programming algorithm course namely the large group test on student learning outcomes in cognitive, affective and psychomotor obtained through tests. In addition, it also categorizes students into HOTS criteria and their improvement through N-gain testing. Furthermore, it is analyzed quantitatively and inferential test techniques through prerequisite tests. The learning outcomes data obtained are described quantitatively such as playing, mode, standard deviation, minimum and maximum values. Then calculate the descriptive analysis using the SPSS version 25 application.

## Results

In this era of increasingly sophisticated technological disruption, teachers and students are required to have the ability in the field of learning technology, and this is a common challenge. These facilities can be used optimally, as a medium in carrying out learning such as in the classroom, for example, teachers create creative video content as teaching materials. In this case, the teacher is more persuasive because it makes students more interested in the material provided by the teacher through the creative video. With these media, indirectly the ability to use and access technology

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A study on learning programming algorithms shows that the difficulty experienced by students is when they are at the stage of understanding the problem, students are not able to translate the problem into a programming language, such as deriving variables and data types needed. In the writing (coding) stage, some still do not master the syntax so that they are hampered in the problem solving process. In the review stage, the difficulty faced is the lack of mastery of debugging, both to correct writing errors and logic or algorithm errors. (Maryono, 2016).

Many learning strategies use problems, but a key defining characteristic of problem-based learning is that students experience problems early in the learning process before other curricula are included. The four key characteristics of PBL are: a). problem, b). PBL tutorials, c). PBL process, d). Learning (Barrett, 2017). On the other hand, there is also a learning model that heavily utilizes technology in the process, namely the Flipped Classroom learning model. The Flipped Classroom learning model is a learning model in which students before studying in class learn the material first at home according to the topic of discussion and there are assignments given by the lecturer. This method is also used when a student is absent from class for some reason. Teachers and lecturers can make videos of what they teach and give to those who don't enter the class (Bergmann & Sams A, 2011). This concept explains that learning occurs from student actions, and educators only play a role in facilitating the occurrence of

knowledge construction activities by learners. (Pierce & Jones, nd).

Then to find out in this study whether there is a difference in the results score experimental class learning the application of the model problem based flipped classroom in the programming algorithm course, and in the control class it is applied to the conventional model, then it is done Analysis of independent sample t-test/t-test. The t-test results obtained from the t-test analysis show that the t-count score is 6.671 when compared to the critical price t-table for df 36 at a significance of 0.05, which is 1.68, it is known that  $t\text{-count} > t\text{-table}$  which means that the hypothesis is null ( $H_0$ ) is rejected and the research hypothesis ( $H_a$ ) is accepted or significant, which means that there are differences in student learning outcomes in the experimental class that the model applies to problem based flipped classroom in the programming algorithm course is better than the control class applied to the conventional model. So it is concluded that the model implementation problem based flipped classroom proven effective. The affective assessment in this study is the 4C assessment which aims to find out Critical Thinking, Communication, Collaboration, and Creativity. Based on the results of the student's 4C affective assessment, namely in the realm of Critical Thinking, Communication, Collaboration and Creativity. Showing results to observer I were 77.7, 82.1, 76.1 and 85.6, respectively. Meanwhile, the second observers were 78.7, 82.9, 76.8 and 86. Meanwhile, the average 4C abilities of the two observers were 78.2, 82.5, 76.45 and 85.8, respectively. From the results of the 4C capability, it can be seen that the Creativity aspect is superior.

### Conclusions

Based on the results of the analysis and development of the problem based flipped classroom model, the following conclusions were drawn, The problem based flipped classroom learning model in the programming algorithm course was developed by adopting the ADDIE development model through the following stages: (a) Analysis (b) Design (c) Development, (d) Implementation. (e) Evaluation. This research has produced a problem based flipped classroom model in the programming algorithm course, with the following model syntax: 1) Pre-class Learning.

2) Online Brainstorming 3) Self Study 4) Reporting 5) Brief Review 6) Evaluation. The effectiveness of the problem based flipped classroom model has been measured covering aspects of the affective, cognitive, and psychomotor in experimental class and control class students using conventional learning models with ed-link media. The results prove that the problem-based flipped classroom model is more effective.

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