

Research Article

Design of Flipped Classroom Learning in Vocational Education to improve HOT Skills in the era of the Industrial Revolution 4.0

Ambiyar^{1*}, Raimon Efendi², Waskito¹, Iffah Rojiyyah¹ and Ratih Agustin Wulandari²

¹Universitas Negeri Padang, Sumatera Barat, Indonesia

²Universitas Dharmas Indonesia, Dharmasraya, Indonesia

Abstract.

This study aims to describe and analyze how the flipped classroom learning model design in Computer Network Security learning in Information Systems Study Program, Faculty of Computer Science. This study aims to design and develop a flipped classroom model to improve 21st century learning ability (4C). The type of development method used is Research and Development (R & D). The development procedure used is 4-D, and is part of the development stage of a learning model. The type of data used is primary data where data is obtained directly from universities, lecturers, experts and students. The results of research based on needs analysis and literature reviews have produced a flipped classroom model design, and based on the results of expert validation it can be concluded that the website-based flipped classroom design is considered quality to measure student competency achievement consisting of menu material, student recap, questions, concept understanding, assessment self, character values, and recap values. Based on the validation results of all the design indicators for the flipped classroom model which were assessed by the validator from the aspects of the feasibility of the content, the language of the instruments, and the feasibility of the graphic aspects of the valid and feasible categories for testing.

Keywords: HOT skills; flipped; classroom learning; vocational education

Corresponding Author: Ambiyar;
 email: ambiyar@ft.unp.ac.id

Published 03 March 2023

Publishing services provided by
Knowledge E

© Ambiyar et al. This article is distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use and redistribution provided that the original author and source are credited.

Selection and Peer-review under the responsibility of the PVJ-ISHESSH 2021 Conference Committee.

1. Introduction

Technological development is something that cannot be avoided, where the background of the technological revolution in the 21st century is due to the demands of competition in the era of globalization which is increasingly growing rapidly, thus demanding that humans produce new inventions. Technology has also become a basic human need in this century to make life even easier. In addition, the existence of increasing world competition also demands humans to be more digitally literate [1] [4]. The ability of information technology without leaving the aspects of the development of attitudes, cognitive abilities and communication is an element that is expected to be integrated in the application of education in the 21st century [5] [6]. Synchronization of


OPEN ACCESS

teaching and learning programs that are integrated with technology with full internet access is needed to meet the absorption of the components involved in vocational education [4] [7] [8]. This is done to respond to the paradigm of the world of work, as well as the challenge of business competition which is full of space due to the increasing use of appropriate digital technology to achieve the desired learning outcomes, namely achieving competitive human resources in the 21st century [4] [8].

Flipped classroom learning model is a learning model in which students are given learning material in the form of video and reading material to be taught in class to be studied at home [9]. In traditional learning, the leader of the class is the teacher, students as the object of learning, learning styles follow the teacher's instructions, students like following other activities. This means that the flipped classroom-based learning model prioritizes the student learning process to gain knowledge rather than the learning model which only considers students as learning objects [10]. Flipped classroom learning forms interactions between students and students and between students and teachers to be actively involved in problem solving [11]. A teacher must develop his professional skills by making his own videos starting with a simple one, or the teacher can take short videos from sites like Ted-Ed and Khan Academy and combine the two for more optimal learning [12]. In principle, making teaching materials in the form of video flipped classrooms is an important part of this model. The making of videos is adjusted to the teacher's ability by looking at the indicators to be achieved in the material [13].

In class activities, students engage in group activities and complete learning concepts and skills, working together on a given project while the instructor helps students individually [14] [15]. This means that with the flipped classroom-based learning model prioritizing cooperation between students, experimental activities to improve student skills in learning. The flipped classroom model approach is effective in helping students learn the material, increasing their ability to solve problems independently. The conclusion is that by applying a learning model based on flipped classroom, students are able to interact intensively in the classroom, so that learning independence is formed [16]. Students can learn more using the flipped classroom model than regular lectures. They enjoy group work, interaction with peers, feel more comfortable asking questions, conducting group discussions, presentations or problem solving to train students to be independent and active [17]. With the flipped classroom model, students have the responsibility for their learning when they watch videos at home and when organizing class learning. This flipped classroom-based learning model prioritizes interaction with peers, conducting group discussions, presentations and problem solving to integrate

cognitive abilities at the application and analysis level [10]. The Flipped Classroom learning model exists because of technological developments that have a major impact on the world of education. Today's increasingly sophisticated technology can become an effective learning facility for teachers and students [18]. Flipped Classroom was first introduced, that the benefits of using multimedia devices such as videos were given to students before learning in class so that students could watch, play back or speed up according to the needs of each student. Flipped Classroom is also a principled concept to exchange classroom activities such as teacher explanations through class presentations, with activities that are usually carried out outside the classroom such as doing homework.

2. Methods

The method used in this research is the research and development method (Research and Development). This 4-D model has advantages, including; it is more appropriate to be used as a basis for developing learning tools not for developing a learning system; its description looks more complete and systematic; and development it involves expert judgment, so that before testing in field learning tools have been revised based on assessments, suggestions and input from experts. Based on the 4-D development model above, the design stages that were carried out in this development research consisted of the Defining stage (Define). The implementation of this research begins with the define stage. The define stage aims to determine the basic problems needed in the development of the Flipped Classroom learning model in Network Administration Learning.

3. Results and Discussion

3.1. Define

The definition stage is carried out to see an overview of how conditions in the field are related to the learning process in the Computer Network Security course for Even Semester Students of Information Systems Study Program, Faculty of Computer Science, Dharmas University Indonesia. At this stage, a needs analysis is carried out aimed at seeing the current conditions and the needs of students and lecturers in learning computer networks, so that at this stage it can describe the discrepancy between the current state and the priorities / student needs regarding student competence in the

21st century and the learning evaluation process that is expected in learning computer networks in higher education.

The priority of lecturers in improving the quality of computer network learning shows that lecturers have high expectations of the learning process. Lecturers' expectations of the learning process are expected to be able to improve the learning competence of the 21st century (4C). The description of the discrepancy between the current state and the priority/student needs which can be assumed that the lecturer needs an innovative learning evaluation model in exploring the abilities of students in the learning process. Students' priorities / needs for the learning process of computer networks have high expectations in the learning process of computer networks. Students' expectations of 21st century competencies are in the high category with an average of 4.8, which means that students need to develop a learning evaluation model that is more effective and efficient in developing their academic potential. Based on this needs analysis, a development of an evaluation model based on authentic assessment is carried out that supports learning.

3.2. Design

This stage is the design of the learning model in accordance with the design that has been made. The results of the design of the learning model consist of a design model and a supporting system in the form of web learning based on flipped classroom. The design stage is the process of solving problems found in the analysis stage to design developed scenarios or learning models. In the design process, a learning model is formulated by developing the stages (syntax) of the flipped classroom model, model books, then designing teaching guides for lecturers (learning tools), computer network modules, and designing e-learning (Web) based learning media. At this stage the design is still conceptual and will underlie the next development process.

The flipped classroom learning model approach refers to the learning design model of Morrison, Kemp and Ross [19]. This model is a learning design model that is circular so that learning development can be started from any component. The output and impact of implementing the flipped classroom model in computer network learning is expected that students will have adequate knowledge and skills in the IT field to support the development and application of computer networks in the industrial / work world. Based on the stages of the approach that has been taken, a hypothetical model framework of flipped classroom is obtained which is depicted in Figure 1. The

explanation of each syntax in the flipped CL model developed is considered to have a novelty that distinguishes it from other research models, namely as follows:

3.2.1. Orientation Learning Outcomes

This learning process orientation is applied to understand and improve the process and provide instruction in learning. This is very important in learning, because it deals with various conditions that exist in terms of students, devices, and existing learning supporters, events that occur and learning preparation to see student readiness in learning to acquire knowledge and increase understanding. Orientation will also provide a clear picture of the learning outcomes that will be achieved in learning. The learning settings are carried out synchronously and asynchronously.

3.2.2. Individual Research and Literation Information (Pre-Class)

In learning flipped classroom, students first learn the topic themselves, usually using video lessons made by the teacher or together by other educators, the teacher does not have to create their own learning videos. Then in class, students then try to apply the knowledge by solving problems and doing practical work. At this stage, students can access online material content freely in class in the form of textbooks, powerpoints, video tutorials, e-books, and as a complement outside the classroom such as studying material that students have not completed in class, complementing material topics through Digital learning resources and in the form of practical examples, supported by existing learning activities such as interactive communication through the use of chat, forums and video conferences to interact anywhere and anytime online.

3.2.3. Assignment Group Learning (Discuss & Presentation)

At this stage, the process of dividing learning groups (origin groups) is carried out according to the assigned material, formulating real problems on each topic in order to train students to think critically and find solutions to each problem presented in the next stage. There is an assignment group to make an assignment which will be grouped face to face in the class, then giving discussion topics and assignments, students discussing the assignment then making the assignment outside the classroom online. At this stage to each group, the lecturer explains the basic concepts, and divides the study groups according to the assigned material, and guides the initial discussion of the study group.

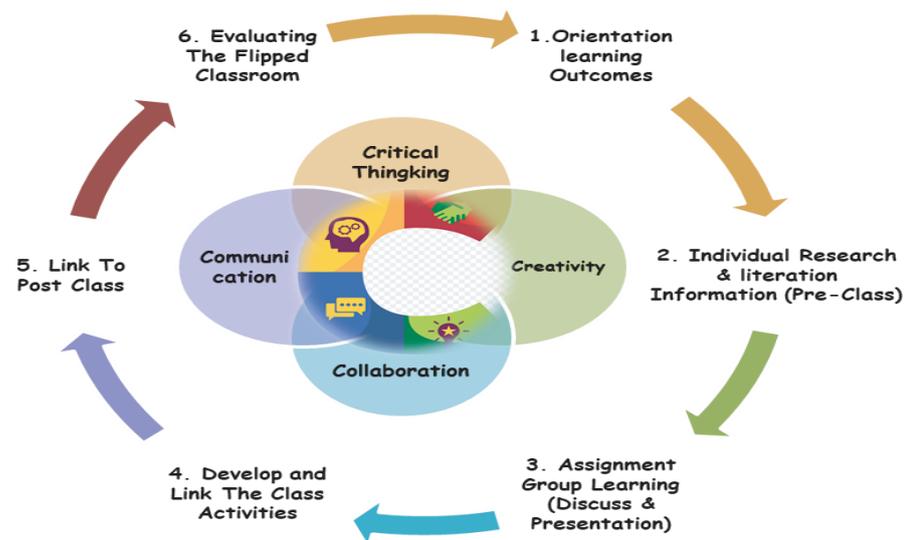


Figure 1: The developed Flipped Blended Learning Model.

3.2.4. Develop and Link The Class Activities

At this stage the process is carried out offline and online, the discussion process and assignment progress can be monitored face-to-face in class and also when learning online through recorded history on e-learning systems, portfolios, video conferences to report project development results, and conduct discussions. Then, to conduct discussions, you can add discussion elements virtually via video conferencing and forums. This discussion contains elements of critical thinking to study project material topics in accordance with 4C competencies.

3.2.5. Link to Post Class

At this stage learning activities are carried out by providing reviews or feedback to groups that have carried out demonstrations, simulations, or practicums, giving directions to groups that are presenting, guiding students or groups of students who still do not understand the material that has been studied, Facilitating participants students or groups of students who have completed this Staged task aim to develop students' ability to communicate orally through group presentations, and develop student abilities so that they can respect other people's opinions. At this stage it is also carried out to reflect on what has been learned on each topic.

3.2.6. Evaluating

Evaluation of learning experiences is carried out at this stage, constructivist learning theory admits that students will be able to interpret the information into their minds, only in the context of their own experiences and knowledge, on their needs, backgrounds and interests. Lecturers can help students constructing their understanding and learning experience, so that the learning process they go through is meaningful. Evaluations are carried out by online cognitive tests and psychomotor tests, as well as attitude assessments that include 4Cs during the learning process. After the prototype is designed, the development stage is carried out. The development stage aims to obtain valid, practical and effective product results. The development stage is divided into two activities, namely: validation of learning media and development trials.

The flipped classroom learning model in the process is also supported by the use of e-learning with the domain address <https://competency-flipped.com>, this e-learning media is able to support the learning process by providing content or menus that can facilitate lecturers in the learning process such as; online attendance, Computer Based Test (CBT) -based exams, discussion forums, assignment assessments. Basically, flipped classrooms take advantage of developments in the world of information technology for education. These developments help in the world of good education. With this pattern, it will create an active learning environment involving information technology. So that information technology becomes the main thing and is absolutely full of the use of flipped classrooms. Even though it has been produced since the define and design stage, the new design results can be considered as an early version of the instructional product that still has to be modified before it can produce the final, perfect version. At the development stage, feedback is received through formative evaluation. A number of experts have been asked to evaluate the initial design from an instructional and technical point of view. As a basis for feedback, the products developed are then modified to make them more suitable, effective, useful, and of high quality and validity.

The results of the expert review validation have a good resistance level compared to other validation techniques. The results of the validation carried out by the validator on the aspects of the feasibility of the contents of the model product validity instrument are categorized as meeting scientific criteria in product development. The results of the validation of all indicators assessed by the validator from the aspects of the feasibility of the content, the language, and the feasibility of the graphic are valid and feasible for testing. The results of media validation were obtained from three media expert validators. The results of the lecturer response questionnaire were obtained from one subject

lecturer who was a media user in carrying out the learning process in the experimental group. Lecturers provide an assessment score in filling out a response questionnaire consisting of 21 assessment items covering aspects of appearance, aspects of use and aspects of interactivity.

The product deployment process is the final stage of development. This stage is carried out to promote the resulting product so that it can be accepted by users, whether individuals, groups or systems. Distribution can be done in other classes with the aim of knowing the effectiveness of using the device in the learning process. Dissemination aims to get input, corrections, suggestions, assessments, to improve the final product development. This deployment stage can also be done online. This research has resulted in a flipped classroom model, which is applied to limited classes, which is expected to be widely applied to learning other computer courses as well as in subjects that have the same characteristics. In conclusion, the model developed is classified as a flipped classroom model with all its supporting components. The model developed is also classified as practical, so it can be used in learning. Meanwhile, for students' final achievement, the application of the flipped blended learning model increased student HOTS.

4. Conclusions

In this study, the learning model that has been developed is the flipped classroom learning model which consists of a combination of text, images and video which is made more attractive to visualize the material so that it can be understood more by students. The use of the flipped classroom learning model that is integrated with the internet and learning videos during learning is expected to be able to reduce weaknesses in teaching materials in the form of printed media, which are interactive in nature which makes it easier to navigate which displays images, audio, video and animation. Flipped classrooms are a way that educators can provide by minimizing the amount of direct instruction in their teaching practice while maximizing interactions with each other.

References

- [1] van Laar E, van Deursen AJ, van Dijk JA, de Haan J. Determinants of 21st-century digital skills: A large-scale survey among working professionals. *Comput. Human Behav.* 2019;100(July):93–104. doi: 10.1016/j.chb.2019.06.017.

- [2] Ambiyar YI, Efendi R, Waskito, Yondri S. Pengembangan e-authentic asesment berbasis PBL untuk meningkatkan kompetensi mahasiswa dalam pembelajaran jaringan komputer. *Rekayasa Sist. dan Teknol. Inf.* 2019;3(3):470–478.
- [3] Efendi R, Jama J, Yulastri A. Development of competency based learning model in learning computer networks. *J. Phys. Conf. Ser.* 2019;1387(1):0–6. doi: 10.1088/1742-6596/1387/1/012109.
- [4] Friadi J, Ganefri, Ridwan, Efendi R. Development of product based learning-teaching factory in the disruption era. *Int. J. Adv. Sci. Technol.* 2020;29(6):1887–1898.
- [5] P21 Framework Definition. 2015. Partnership for 21st Century Learning. Available from: http://www.p21.org/our-work/p21-framework/P21_Framework_Definitions_New_Logo2015.pdf%0A. [Accessed: 15-Sep-2018].
- [6] Association NE. Preparing 21st century students for a global society: An educator's guide to the "Four Cs". 2010.
- [7] Suryana F, Jalinus N, Rahmad R, Efendi R. Cooperative project based learning models in programming languages: A proposed. *Int. J. Adv. Sci. Technol.* 2020;29(6):1876–1886.
- [8] Efendi AYR. Effectiveness of collaborative problem based learning model of learning computer network courses BT. 5th UPI Int. Conf. Tech. Vocat. Educ. Train. (ICTVET 2018); 2019 February. doi: <https://doi.org/10.2991/ictvet-18.2019.70>.
- [9] González-Gómez D, Jeong JS, Rodríguez DA, Cañada-Cañada F. Performance and perception in the flipped learning model: An initial approach to evaluate the effectiveness of a new teaching methodology in a general science classroom. *J. Sci. Educ. Technol.* 2016;25:450–459.
- [10] Sales N. Flipping the classroom: Revolutionising legal research training. *Leg. Inf. Manag.* 2013;13(4):231–235. doi: 10.1017/S1472669613000534.
- [11] Velegol SB, Zappe SE. The evolution of a flipped classroom: evidence-based recommendations. *Advances in Engineering Education.* 2015;4(3):1–38.
- [12] Hawks SJ. The flipped classroom: now or never? *AANA journal.* 2014;82(4):264–269.
- [13] Raths D. 9 video tips for a better flipped classroom. *THE Journal.* 2013. Available from: <https://thejournal.com/articles/2013/11/18/9-video-tips-for-a-better-flipped-classroom.aspx>.
- [14] Hidayati A, Saputra A, Efendi R. Development of e-module oriented flipped classroom strategies in computer network learnin. *Rekayasa Sist. dan Teknol. Inf.* 2020;4(3):429–437. doi: <https://doi.org/10.29207/resti.v4i3.1641>.

- [15] Ambiyar YI, Efendi R, Waskito, Yondri S. Pengembangan e-authentic asesment berbasis PBL untuk meningkatkan kompetensi mahasiswa dalam pembelajaran jaringan komputer. *Rekayasa Sist. dan Teknol. Inf.* 2019;3(3).
- [16] Enfield J. Looking at the impact of the flipped classroom model of instruction on undergraduate multimedia students at CSUN. *TechTrends.* 2013;57(6):14–27. doi: 10.1007/s11528-013-0698-1.
- [17] B. Love, A. Hodge, N. Grandgenett, and A. Swift, “Student learning and perceptions in a flipped linear algebra course,” *Int. J. Math. Educ. Sci. Technol.*, vol. 45, 2014, doi: 10.1080/0020739X.2013.822582.
- [18] J. Bergman and A. Sams, *Flip Your Classroom: Reach Every Student in Every Class Every Day*, 1st ed. International Society for Technology in Education. ASCD®, 2012.
- [19] G. R. Morrison, S. M. Ross, H. K. Kalman, and J. E. Kemp, *Designing Effective Instruction*. Wiley, 2012.