

Application of the Collaborative Project-Based Learning Model using Moodle in Higher Education

Irwan¹

Computer Science Faculty, Institut Bisnis dan Teknologi Pelita Indonesia, Pekanbaru, Indonesia

Wilda Susanti³

Computer Science Faculty, Institut Bisnis dan Teknologi Pelita Indonesia, Pekanbaru, Indonesia

Wakhinuddin⁵

Engineering Faculty, Universitas Negeri Padang, Padang, Indonesia

Ramalia Noratama Putri⁷

Computer Science Faculty, Institut Bisnis dan Teknologi Pelita Indonesia, Pekanbaru, Indonesia

Yenny Desnelita²

Computer Science Faculty, Institut Bisnis dan Teknologi Pelita Indonesia, Pekanbaru, Indonesia

Gustientiedina⁴

Computer Science Faculty, Institut Bisnis dan Teknologi Pelita Indonesia, Pekanbaru, Indonesia

Fahmi Rizal⁶

Engineering Faculty, Universitas Negeri Padang, Padang, Indonesia

Dony Novaliendry⁸

Electronic Department, Engineering Faculty, Universitas Negeri Padang, Padang, Indonesia

²Corresponding author: Computer Science Faculty, Institut Bisnis dan Teknologi Pelita Indonesia, Pekanbaru, Indonesia, Email: yenny.desnelita@lecturer.pelitaindonesia.ac.id

Abstract

Higher education's learning process uses the Collaborative Project-Based Learning (CPBL) Model, which is implemented into the Modular Object Oriented Dynamic Learning Environment (MOODLE). This application program can change learning media web-based. The CPBL model is learning that uses problems with projects that can be identified in scenarios to increase knowledge and understanding of the learning process. The CPBL Learning Model using Moodle has excellent potential in higher education because it provides knowledge construction and skills development related to interactions that result in a more essential learning process built to overcome problems in the teaching and learning process educators. This study aims to implement e-learning with the moodle-based CPBL model and Virtual Remote Labs (VRLs). Based on a conceptual review of the CPBL type of learning model, this paper explores Virtual Remote Labs (VRLs) using Moodle for concrete experiences in higher education. In the Moodle application, there are several learning activities to form groups using the CPBL model syntax. The Moodle application plugin is designed to upload and deliver learning materials, face-to-face, and practical work with VRLs using the CPBL model syntax in universities. This study requires careful planning, dynamics, sufficient to form collaborative groups and the relevance of student practice related to the use of VRLs technology with Moodle for changing teaching roles and autonomy in the management of learning in universities.

Keywords

CPBL, Moodle, VRLs, Higher Education

To cite this article: Irwan, Desnelita Y, Susanti W, Gustientiedina, Wakhinuddin, Rizal F, Putri R, N, and Novaliendry D. (2021) Application of the Collaborative Project-Based Learning Model using Moodle in Higher Education. Review of International Geographical Education (RIGEO), 11(9), 2141-2149. Doi: 10.48047/rigeo.11.09.187

Submitted: 19-11-2020 • **Revised:** 10-02-2021 • **Accepted:** 15-03-2021

Introduction

The development of science and technology requires that universities as formal educational institutions can produce quality graduates. Learning in institutions should be more innovative and creative in producing graduates. The concept of distance education has been the most frequently used learning method until now, especially during the Covid-19 pandemic. The research findings show that receiving moodle in distance learning can access information anytime and anywhere who uses it (Caliskan & Bicen, 2016). Learning models personalized with information technology can increase the interaction between students and teaching staff (Novaliendry et al., 2020; Krismadinata et al., 2020; Uzunboyly & Karagozlu, 2015). Technological developments have given rise to new forms of group work using e-learning, where e-learning improves teaching conditions regardless of time and space (Novaliendry et al., 2015, 2020; Yang et al., 2020). Educational content management learning platform emphasized social constructivist education, promoting knowledge sharing in group work (Yassine et al., 2013). Pedagogy is characterized by a social and collective nature, which is others' criticality, group work, and collaboration. According to project actors, all of these characteristics generate labour and tasks division, and planning tasks lead to affective and motivational investment (Capra & Arpin, 2002). Providing projects using a collaborative learning process, lecturers can determine structured and unstructured activities according to the syntax of the CPBL model assisted by using the Moodle application as a learning medium in Higher Education. Research on Collaborative Learning (CL) and Project-Based Learning (CPL) is found in the results of the development of research (De Laat et al., 2007; Inthachot et al., 2013; Lehtinen et al., 1999; So & Bonk, 2010; Zhang, 2012). Collaborative learning has great potential in education as it promotes the construction of shared knowledge and develops skills that interact with groups resulting in a critical thinking learning process (Herrera-Pavo, 2021). Project-Based Learning (PBL) can combine learning activities parallel with conceptual theory material, simulations, and experimental work through small projects on real systems (Costa-Castelló et al., 2014). Collaborative Project-Based Learning (CPBL) application in the teaching and learning process can stimulate motivation, process and improve student learning achievement by using problems in real situations. This is because a tangible and meaningful use of knowledge and skills can be constructed through authentic tasks and jobs. The difference between Project-Based Learning and other learning methods is in the basic concepts and principles of a scientific discipline, involving students in solving problems and other flexible activities, allowing students to work independently or autonomously exploring their knowledge, and producing real products. Learning that is done through face-to-face can traditionally be converted into e-learning so that it becomes active learning (Cahyono, 2017; Koochang, 2009) and research (Capra & Arpin, 2002) where active learning can produce a strengthening of HOT thinking skills. So that students gain knowledge and in-depth learning experience, have the ability and expertise to work in the world of work (Cahyono, 2017). Using a communication platform to help facilitate learning on the CPBL model, teamwork can use social media such as chat rooms on e-learning platforms (F.-L. L. Fu et al., 2015). The satisfaction of the benefits of interactive, assessment, schedules, learning strategies, and collaborative learning provided using e-learning (F.-L. Fu, 2010; F.-L. L. Fu et al., 2015; Kuo et al., 2014; Liaw & Huang, 2013; So & Brush, 2008) which in this study used Moodle. The results of other studies have found that virtual spaces, namely forums, online tutorials, and communication tools, are beneficial to collaboratives (Herrera-Pavo, 2021). A study (Trilaksono & Santoso, 2017) implemented a learning design on a Learning Management System (LSM) that was used for academic purposes using an open-source Modular object-oriented dynamic learning environment (Moodle). Research provides integration between remote Virtual Labs (VRLs) and Moodle using the EISApp plugin (Guinaldo et al., 2013). VRLs have a computer-based usable interface that looks and uses similar to traditional activities (Guimaraes et al., 2010). The development of VRLs is Moodle and Easy Java Simulation (EJS), where EJS where research groups widely use ESJ in creating virtual laboratories and Graphical User Interface (GUI) for distance learning (Vargas et al., 2010). The LSM is the form of Moodle commonly used in supporting constructivist learning, which has an interface for user interaction (Rice, 2011).

Materials and Methods

The Architecture

A tool that can be used to practice VRLs on the internet. Any VRLs must be provided, is a

description of the phenomenon and setting understudy from experiments for distance learning. Students must follow the assignment protocol to achieve the goal, using a widespread LSM (Moodle) customized to support online learning features. The Moodle application has a user interface to assist communication in user icons and online messages. To support one-click VRL deployment to moodle using the VRLab and SyncollabSession plugins which extend LSM (Moodle), can support collaborative learning for VRLab (Vargas et al., 2010). Figure 1 of the research results (Vargas et al., 2010) describes a form of communication using collaborative parts. The user first connects to the Moodle server and downloads the applet for the VRLs implementation, which will be used every meeting in the lesson. On the other hand, users can participate in discussions and interact with each other through serverless collaboration using TCP and UDP. This communication framework supports simultaneously without overloading the Moodle server.

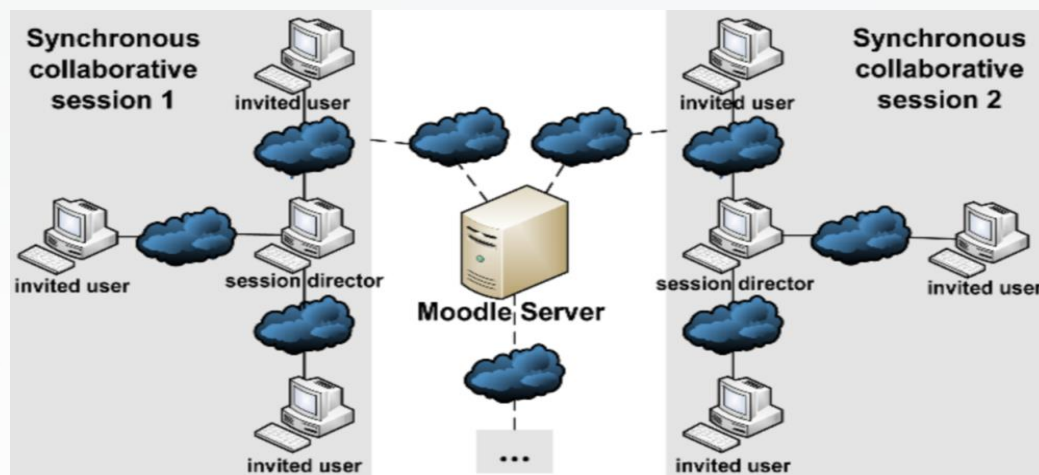


Figure 1 A Network Framework at Collaborative Meetings (Vargas et al., 2010).

In collaboration meetings using the Moodle plugin's participation forum, which can be installed and displayed visual information about student participation. A lecturer can call students to participate in discussion forums, changing the learning process to be more collaborative and participatory (Muñoz et al., 2017). Figure 2 shows that Moodle has a modular architecture (Muoz et al., 2017), allowing other users to install the Moodle platform for participant forums on the standard Moodle architecture (Muñoz et al., 2017).

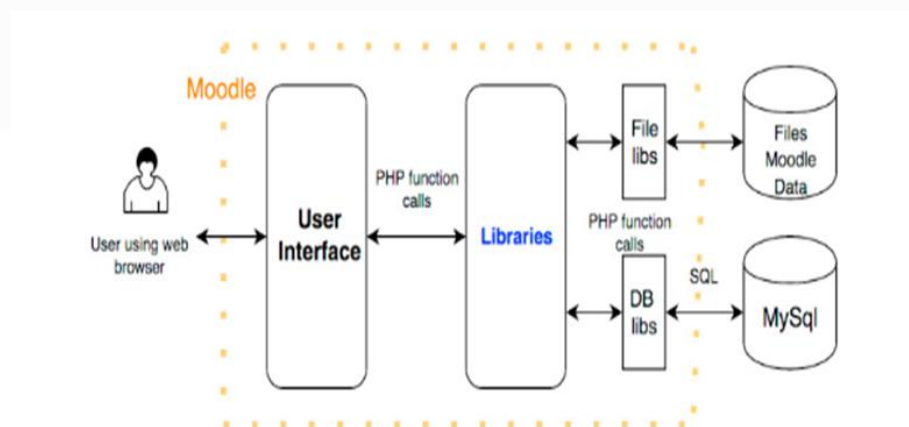


Figure 2 Moodle's third layer architectural framework (Muñoz et al., 2017).

The Moodle application can implement group-based learning activities using collaborative learning. The CPBL model has not been designed while learning activities using the CPBL model can be found in the Moodle application. The form is scattered. It can be designed to support the syntax in the CPBL model (Peramunugamage et al., 2019). Figure 3, all students can register through the given Moodle account to enter the learning forum that uses the PBL model. Lecturers can call students to enter the Moodle application to be involved in the implementation of online

learning. The Moodle application provides space to form groups using the PBL model, and lecturers carry out problem-based learning activities on the courses offered in the Moodle application.

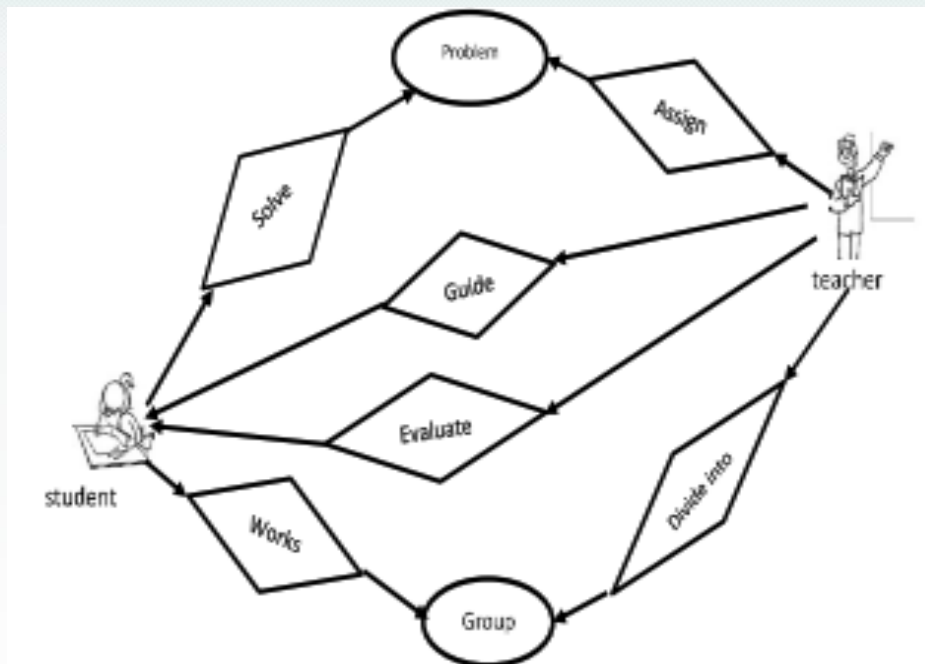


Figure 3 An overview of the PBL process (Peramunugamage et al., 2019).

The main problem is broken down into several sub-problems, then students work on the given issues according to the predetermined groups. The group works in a different virtual room and cannot carry out activities in other groups without the lecturer's permission. And students can choose groups to form a team up to the time limit given by the lecturer. In the collaborative process, students can design solutions to problems given, and lecturers monitor and respond to each group's discussion (Peramunugamage et al., 2019). PBL activities in Moodle can carry out activities to assess students, fellow students, and lecturers, where the lecturer can evaluate each student's teamwork. Lecturers and students can see the Moodle application evaluation, and the lecturer can instruct each group team to assess the coalition of other groups. Furthermore, the Moodle application can provide a virtual space involving students in various PBL activities in the form of project assignments, chat, discussion forums, filling out questionnaires, resources, and surveys illustrated in Figure 4.

Results and Discussion

This study's results describe the findings of the study, namely validating the CPBL to find out whether the developed prototype meets user expectations and is parallel to the curriculum in tertiary institutions. In this discussion, the researcher uses the Moodle plugin application.

Moodle Application Design Interface

This section shows the moodle application interface of using the CPBL model. Considering the respondents' responses, the Moodle application interface is illustrated in figures 5 to 10. Figures 5 to 10 illustrate the user interface with the Moodle application plugin for the CPBL model, which helps implement lecturer learning in the distance and mixed learning models. Learning the CPBL model with the Moodle (LSM) application has completed its testing phase. The Moodle plugin can be used with the Moodle web environment to assist lecturers in learning using the CPBL model. In practice, students can carry out activities individually and in groups, and lecturers can see students who participate individually or in teams anytime and anywhere. The following is a Collaborative Project-Based Learning (CPjBL) e-learning that was built: access website cpjbl.elearningpt.com dan access the cpjbl.elearningpt.com website illustrated in figure 5.

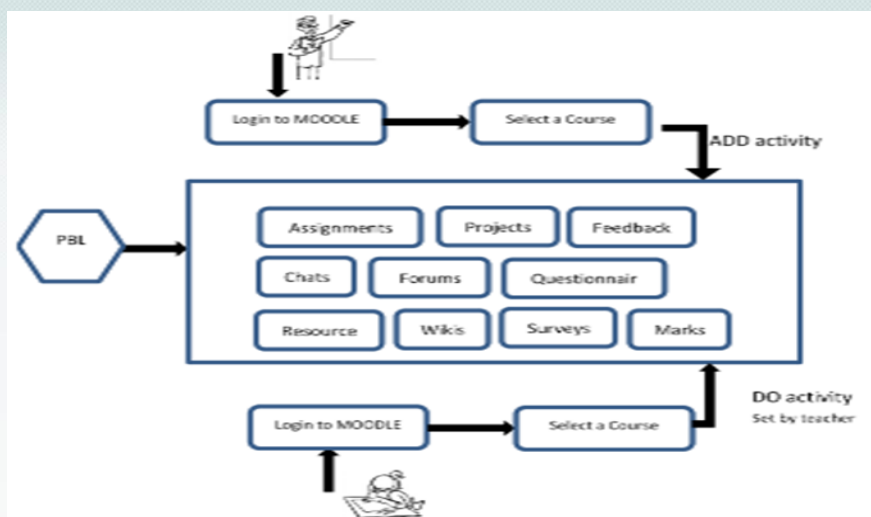


Figure 4 PBL activities in Moodle (Peramunugamage et al., 2019).

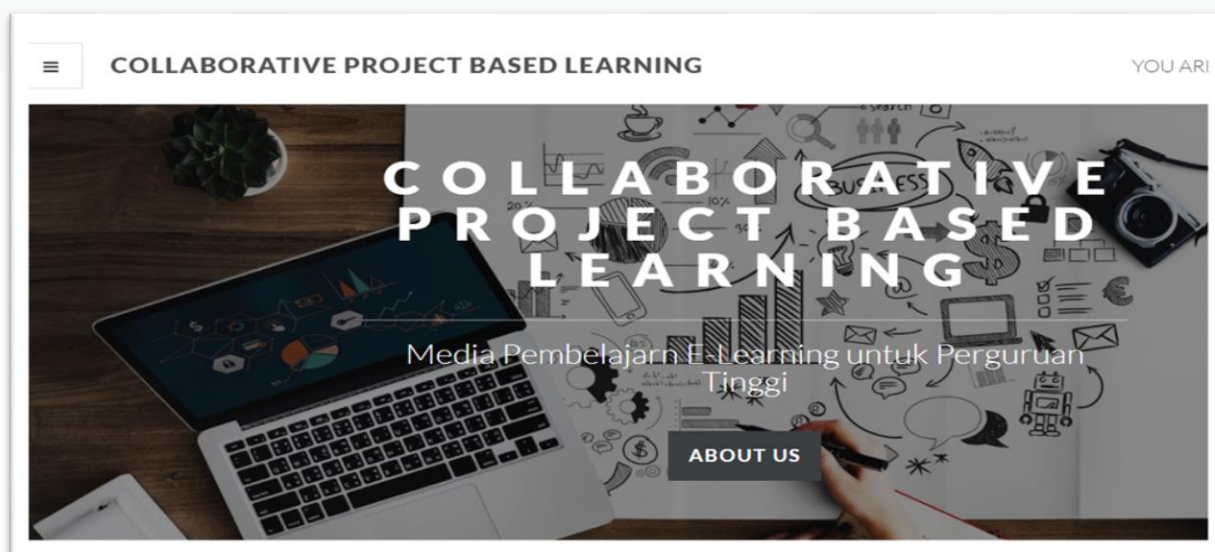


Figure 5 Form Site Home CBPL.

It is a display of the e-learning page of the Collaborative Project-Based Learning product that was built. This application is an initial display before the start of learning in e-learning. Users who use this e-learning are admins who are web managers, lecturers as educators, and students as children.

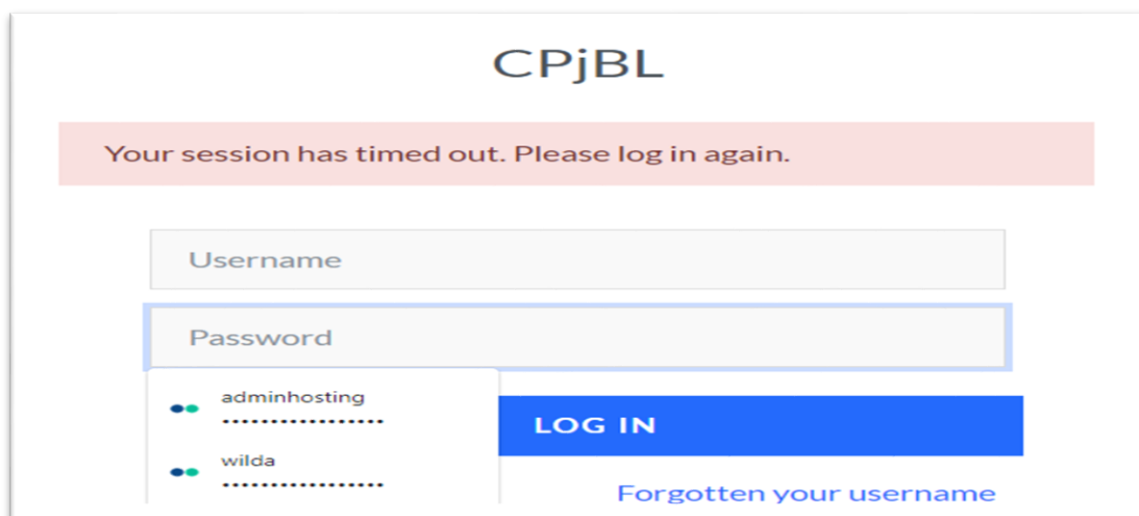


Figure 6 Log into the e-learning web.

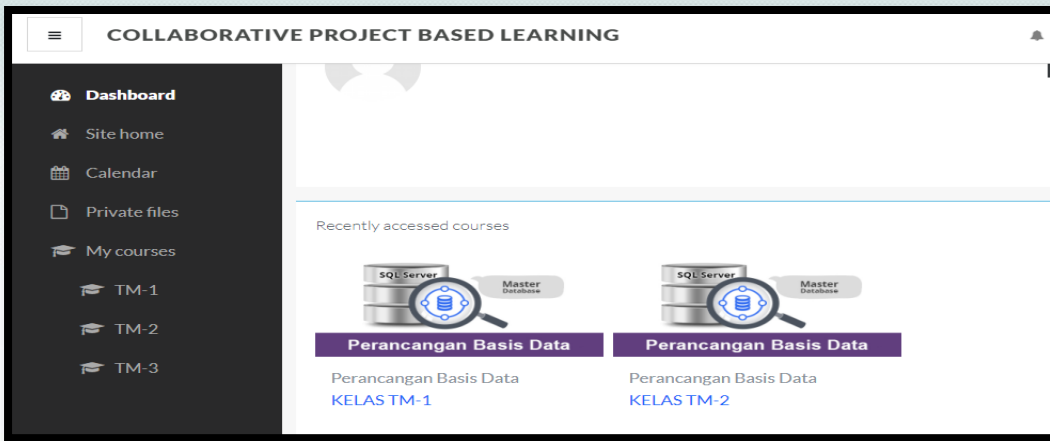


Figure 7 The lecturer page display.



Figure 8 Display Class Learning Menu

This display represents learning in each lecturer's class, and students can study the material provided by the lecturer, and students do live chat with the lecture.

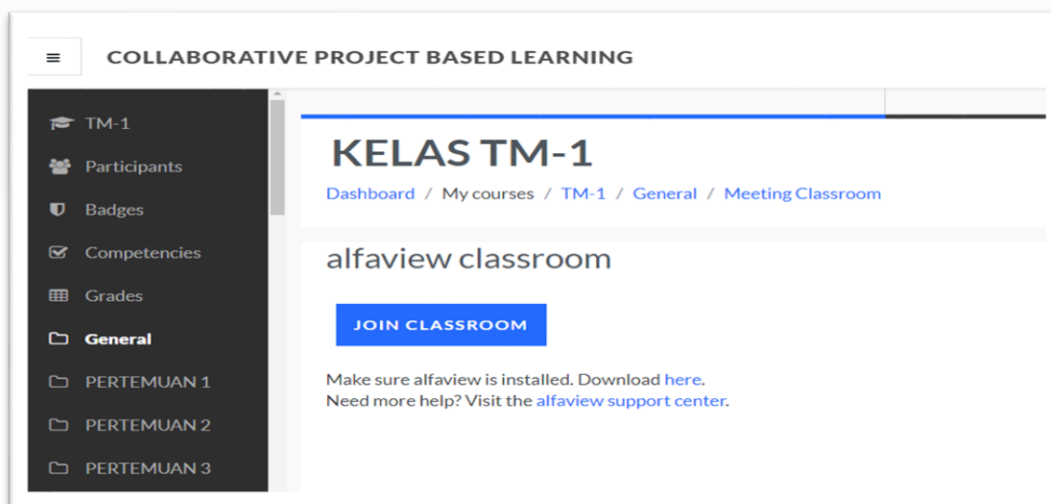


Figure 9 Display class meeting

This view displays students conducting face-to-face meetings between students and lecturers by directly joining the meet.

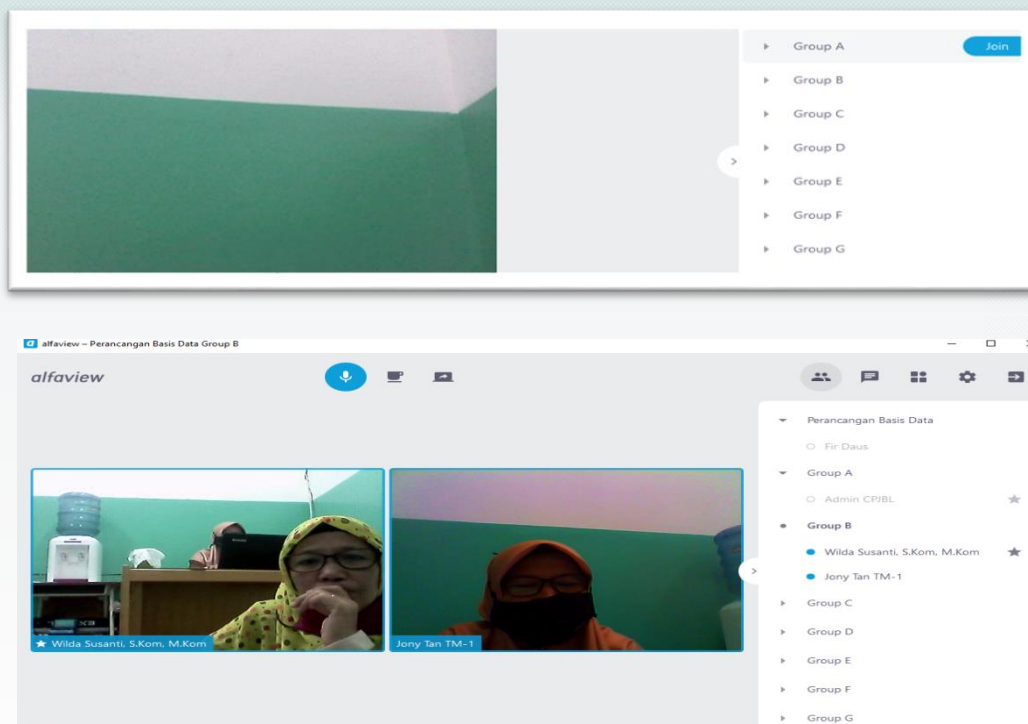


Figure 10 Join the discussion group.

This display displays students doing collaborative work among students. When the lecturer assigns a project assignment, the student directly meets his friends without leaving the e-learning. The discussion group for programming courses continues to the virtual lab application, using the viewer team. Team viewer is a remote desktop application that can remote computer students wherever they are. Students who have done problem-solving in the discussion group conduct trials with the program. The form of computer programming collaboration can be seen in the image below.

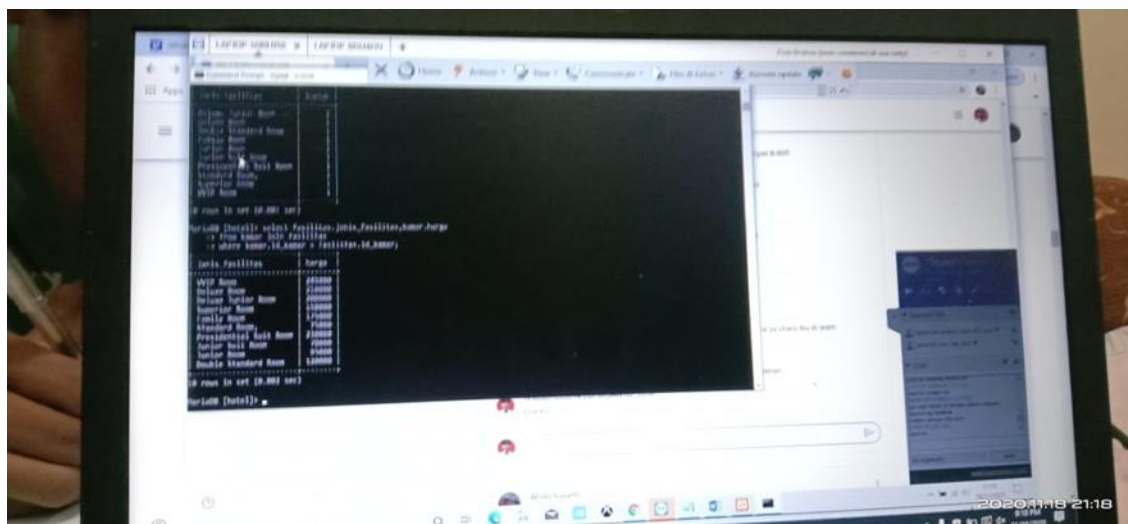


Figure 11 Virtual Programming Lab (VBLs).

Conclusions

This work presents the existing Moodle and Virtual Remote Lab applications. It shows how to reuse them in Higher Education's CPBL model, where researchers place online learning supported by the Moodle application. In the application of the Moodle (LSM) application using the web in the implementation of the CPBL model can improve the fast and simple learning process and improve learning using VRL and Moodle (LSM) for distance learning with new features such as data file

storage, language detection, and configuration automated, ordering system for managing and managing remote laboratory usage, restoring content, setting up access to remote virtual labs.

Acknowledgements

Authors would like to thank the support received from Ristek/BRIN and Institut Bisnis dan Teknologi Pelita Indonesia who have significantly contributed to this research's success.

Reference

- Cahyono, K. (2017). Implementation of Media Interactive Learning Based Wlan Technology (Study at SMK Kampar). *International Journal*, 12(30), 121–125.
- Caliskan, S., & Bicen, H. (2016). Determining the perceptions of teacher candidates on the effectiveness of MOODLE used in flipped education. *Procedia Computer Science*, 102, 654–658.
- Capra, L., & Arpin, L. (2002). La médiation pédagogique de l'enseignant: une composante essentielle dans l'apprentissage par projets. *Québec Français*, 126, 67–71.
- Costa-Castelló, R., Puig, V., & Blesa, J. (2014). Teaching model-based fault detection and isolation using project-based learning on a three-tank system. *IFAC Proceedings Volumes*, 47(3), 9026–9031.
- De Laat, M., Lally, V., Lipponen, L., & Simons, R.-J. (2007). Investigating patterns of interaction in networked learning and computer-supported collaborative learning: A role for Social Network Analysis. *International Journal of Computer-Supported Collaborative Learning*, 2(1), 87–103.
- Dony Novalindry, M. A., Jaya, P., Sriwahyuni, T., Huda, A., Huda, Y., Irfan, D., Ramadhani, D., & Anori, S. (2020). Development of Smart Learning Media Model Based on Android. *International Journal of Engineering Research and Technology*. ISSN, 974–3154.
- Fu, F.-L. (2010). Comparison of students' satisfaction and dissatisfaction factors in different classroom types in higher education. *International Conference on Hybrid Learning*, 415–426.
- Fu, F.-L. L., Lin, C.-L., & Ting, C. (2015). Charisma building in the e-learning classroom: an exploratory study. *Procedia-Social and Behavioral Sciences*, 176, 683–690.
- Guimaraes, E. G., Cardozo, E., Moraes, D. H., & Coelho, P. R. (2010). Design and implementation issues for modern remote laboratories. *IEEE Transactions on Learning Technologies*, 4(2), 149–161.
- Guinaldo, M., de la Torre, L., Heradio, R., & Dormido, S. (2013). A virtual and remote control laboratory in moodle: The ball and beam system. *IFAC Proceedings Volumes*, 46(17), 72–77.
- Herrera-Pavo, M. Á. (2021). Collaborative learning for virtual higher education. *Learning, Culture and Social Interaction*, 28, 100437.
- Inthachot, M., Sopeerak, S., & Rapai, N. (2013). The development of a U-learning instructional model using project based learning approach to enhance students' creating-innovation skills. *Procedia-Social and Behavioral Sciences*, 103, 1011–1015.
- Koohang, A. (2009). A learner-centred model for blended learning design. *International Journal of Innovation and Learning*, 6(1), 76–91.
- Krismadinata, Verawardina, U., Jalinus, N., Rizal, F., Sukardi, Sudira, P., Ramadhani, D., Lubis, A. L., Friadi, J., Arifin, A. S. R., & Novalindry, D. (2020). Blended learning as instructional model in vocational education: Literature review. *Universal Journal of Educational Research*, 8(11B), 5801–5815. <https://doi.org/10.13189/ujer.2020.082214>
- Kuo, Y.-C., Walker, A. E., Schroder, K. E. E., & Belland, B. R. (2014). Interaction, Internet self-efficacy, and self-regulated learning as predictors of student satisfaction in online education courses. *The Internet and Higher Education*, 20, 35–50.
- Lehtinen, E., Hakkarainen, K., Lipponen, L., Rahikainen, M., & Muukkonen, H. (1999). Computer supported collaborative learning: A review. *The JHGI Giesbers Reports on Education*, 10, 1999.
- Liaw, S.-S., & Huang, H.-M. (2013). Perceived satisfaction, perceived usefulness and interactive learning environments as predictors to self-regulation in e-learning environments. *Computers & Education*, 60(1), 14–24.
- Muñoz, A., Delgado, R., Rubio, E., Grilo, C., & Basto-Fernandes, V. (2017). Forum participation

- plugin for Moodle: Development and Discussion. *Procedia Computer Science*, 121, 982–989.
- Muoz, A., Delgado, R., Rubio, E., Grilo, C., & Basto-Fernandes, V. (2017). Forum participation plugin for Moodle. *Procedia Computer Science*, 121(C), 982–989.
- Novaliendry, D., Hendriyani, Y., Yang, C. H., & Hamimi, H. (2015). The optimized K-means clustering algorithms to analyzed the budget revenue expenditure in Padang. *International Conference on Electrical Engineering, Computer Science and Informatics (EECSI)*, 2(August), 61–66. <https://doi.org/10.11591/eecsi.v2i1.771>
- Novaliendry, D., Wattimena, F. Y., Renyaan, A. S., & Luthfini, A. (2020). Development of an Expert System Application to Detect Vitamin Deficiencies in the Human Body. *XXIX*, 956–965. <https://doi.org/10.24205/03276716.2020.1092>
- Peramunugamage, A., Usoof, H., & Hapuarachchi, J. (2019). Moodle mobile plugin for problem-based learning (PBL) in engineering education. *2019 IEEE Global Engineering Education Conference (EDUCON)*, 827–835.
- Rice, W. (2011). *Moodle 2.0 E-Learning Course Development*. Packt Publishing Ltd.
- So, H.-J., & Bonk, C. J. (2010). Examining the roles of blended learning approaches in computer-supported collaborative learning (CSCL) environments: A Delphi study. *Journal of Educational Technology & Society*, 13(3), 189–200.
- So, H.-J., & Brush, T. A. (2008). Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computers & Education*, 51(1), 318–336.
- Trilaksono, K., & Santoso, H. B. (2017). Moodle based learning management system development for kinesthetic learning style. *2017 7th World Engineering Education Forum (WEEF)*, 602–606.
- Uzunboylu, H., & Karagozlu, D. (2015). Flipped classroom: A review of recent literature. *World Journal on Educational Technology: Current Issues*, 142–147.
- Vargas, H., Sánchez, J., Jara, C. A., Candelas, F. A., Torres, F., & Dormido, S. (2010). A network of automatic control web-based laboratories. *IEEE Transactions on Learning Technologies*, 4(3), 197–208.
- Yang, C. H., Novaliendry, D., Chen, J. B., Wattimena, F. Y., Renyaan, A. S., Lizar, Y., Guci, A., Ariyon, M., Ramadhani, D., Verawardina, U., Irwan, Desnelita, Y., Susanti, W., Gustientiedina, Marlina, H., Simeru, A., & Nasution, T. (2020). Prediction of mortality in the hemodialysis patient with diabetes using support vector machine. *Revista Argentina de Clinica Psicologica*, 29(5), 219–232. <https://doi.org/10.24205/03276716.2020.823>
- Yassine, B. T., Faddouli, N. EL, Samir, B., & Idrissi, M. K. (2013). Project-based Learning Modeling Language. *Procedia - Social and Behavioral Sciences*, 106, 2159–2178. <https://doi.org/10.1016/j.sbspro.2013.12.247>
- Zhang, A. (2012). Cooperative learning and soft skills training in an IT course. *Journal of Information Technology Education: Research*, 11(1), 65–79.

Names of 5-9 references

- Irwan, Institut Bisnis dan Teknologi Pelita Indonesia, Pekanbaru, Indonesia, Irwan@lecturer.pelitaindonesia.ac.id
- Yenny Desnelita, Institut Bisnis dan Teknologi Pelita Indonesia, Pekanbaru, Indonesia, yenny.desnelita@lecturer.pelitaindonesia.ac.id
- Wilda Susanti, Institut Bisnis dan Teknologi Pelita Indonesia, Pekanbaru, Indonesia, wilda@lecturer.pelitaindonesia.ac.id
- Gustientiedina, Institut Bisnis dan Teknologi Pelita Indonesia, Pekanbaru, Indonesia, gustientiedina@lecturer.pelitaindonesia.ac.id
- Wakhinuddin, Universitas Negeri Padang, Padang, Indonesia, wakhinuddins@gmail.com
- Fahmi Rizal, Universitas Negeri Padang, Padang, Indonesia, fahmi@ft.unp.ac.id