Tersedia secara online
http://journal.um.ac.id/index.php/jptpp/
EISSN: 2502-471X
DOAJ-SHERPA/RoMEO-Google Scholar-IPI

**Jurnal Pendidikan:**
Teori, Penelitian, dan Pengembangan
Volume: 6 Nomor: 12 Bulan Desember Tahun 2021
Halaman: 1837—1845

# Development of Virlenda-Based Blended Learning with Problem Based Learning Strategy for Problem-Solving Ability for Students

Achmad Noor Fatirul[1], Subandowo[1]
[1]PGRI Adi Buana University Surabaya

**INFO ARTIKEL**

***Riwayat Artikel:***

Diterima: 28-11-2021
Disetujui: 28-12-2021

***Kata kunci:***

*blended learning;*
*problem based learning;*
*solving ability problem;*
*pembelajaran campuran;*
*pembelajaran berbasis masalah;*
*kemampuan memecahkan masalah*

**ABSTRAK**

**Abstract:** This study aims to develop a Virlenda-based blended learning model. The products that will be produced develop learning tools with problem-based learning strategies, problem-based evaluation tools, supplements for lecturers and students and the Virlenda learning management system as a forum for carrying out the learning process. The results of the research are design experts with 85.8% validation percentage, material experts with 86.5 validation percentages, media experts with 87.7% validation percentages, 86.5% validation percentages for colleagues. In the small group trial the percentage of responses was 82.7%, for the medium group trial the percentage of responses was 89.6%, while in the large group trial the percentage was 92%. The results of the products developed can be used as guidelines in the learning process, so that products can be mass-produced to be distributed to universities. In the field group trial comparing the old model and the new model, it got 0.458 for Google Classroom and 0.916 for Virlenda, so Virlenda is significantly better than Google Classroom.

**Abstrak:** Penelitian ini bertujuan untuk mengembangkan model *blended learning* berbasis Virlenda. Produk yang akan dihasilkan mengembangkan perangkat pembelajaran dengan strategi pembelajaran berbasis masalah, perangkat evaluasi berbasis masalah, suplemen untuk dosen dan mahasiswa serta sistem manajemen pembelajaran Virlenda sebagai wadah untuk melaksanakan proses pembelajaran. Hasil penelitian adalah ahli desain dengan persentase validasi 85,8%, ahli materi dengan persentase validasi 86,5, ahli media dengan persentase validasi 87,7%, dan rekan sejawat 86,5%. Pada uji coba kelompok kecil persentase tanggapannya adalah 82,7%, untuk uji coba kelompok sedang persentase tanggapannya adalah 89,6%, sedangkan pada uji coba kelompok besar persentasenya adalah 92%. Hasil produk yang dikembangkan dapat dijadikan pedoman dalam proses pembelajaran, sehingga produk dapat diproduksi secara massal untuk didistribusikan ke perguruan tinggi. Dalam uji coba kelompok lapangan yang membandingkan model lama dan model baru didapat 0,458 untuk *Google Classroom* dan 0,916 untuk Virlenda. Jadi, Virlenda secara signifikan lebih baik daripada *Google Classroom*.

***Alamat Korespondensi:***

Achmad Noor Fatirul
Educational Technology
PGRI Adi Buana University Surabaya
Jl. Dukuh Menanggal XII Surabaya
E-mail: anfatirul@gmail.com

The blended learning model is a learning model that is recommended in the world of education in the 21st century in the industrial era 4.0. Curriculum demands have now shifted from theories that present conventional material to teaching demands with real material. Curriculum demands in universities based on the Indonesian National Qualifications Framework (KKNI) have demanded problem-based learning. Researchers are very motivated to do this research how the learning process is aimed at learning models that are authentic problems. Therefore, the selection of Problem Based Learning strategies as a strategy that strongly supports the demands of the curriculum. What if the problem-based learning strategy is applied in an online learning model such as the Blended Learning model? This is a challenge for all teachers everywhere. Blended learning that can bridge conventional learning that cannot be lost from the habit of every teacher, namely face-to-face which relies on the lecture method accompanied by a power point display can be combined with online learning.

Online learning will lead a college to a digital campus. Quoting Teamsun's opinion in Fatirul (2020) which states that the digital campus is all efforts to change the existing resources in the higher education system to change the learning process with an internet-oriented orientation that can penetrate space and time. The online media used can be used to access information

from sources, it is also used to communicate with other learners and learners (Smaldino, Lowther, Russell, 2011). Online has the ability to convey any information, so that anyone can access electronic documents to enrich their studies, and the most important thing is that students can interact with online learning by providing an interactive environment. (Fatirul, 2020).

According to Carman (2009), there are 5 main keys in implementing blended learning model learning, namely: Live Event, Self-Paced Learning, Collaboration, Assessment, and Performance Support Materials. The diversity in this model is clear that blended learning focuses on synchronous and asynchronous learning, combining independent (individual) and group learning, prioritizing collaboration, always conducting combined assessments, using many sources. Kwang at.al. (2020) expressed the effectiveness of the blended learning model in the learning process, there are many advantages that we can get to improve student performance, learn individually, and improve students' thinking skills significantly.

Alder and Milne (1997) call problem based learning a method that focuses on identifying problems that make up the framework of analysis and solutions. This method is done by creating groups whose performance is carried out in collaboration, discussing things that are not or poorly understood and sharing roles to carry out tasks and report to each other. Wheeler, at al. (2005) said that problem-based learning presents many problems in the form of real problems. White (2001) argues that the problem-based learning method is the most effective method in improving problem-solving skills. Then Arends (2007) outlines that teacher always present authentic problems to students which later students can investigate which increases inquiry that trains children's intellectuals which is carried out openly and to whomever students communicate. White, (2001) makes it clear that in problem-based learning collaborative work is more important which will improve communication skills, increase motivation to learn and be responsible for the results of their work.

This theory underlies that problem-based learning strategies are more effective than other learning strategies (Fatirul, 2012). In carrying out this research, the researcher will refer to the syntax proposed by Arend (2007), the steps or syntax include Provide orientation on problems to students, organize students for research, assist independent and group investigations, Develop and present artifacts and exhibits, and analyze and evaluate the problem-solving process. Ahmet at.al. (2007) and Xiaojie Ding at.al. (2014) argues that PBL achieves a high score, makes learning more effective, can motivate students, can improve independent learning, and can improve knowledge, attitudes, and skills.

How this learning model is also applied in online learning, of course, requires a forum known as a Learning Management System (LMS). Many LMS have developed in recent times. PGRI Adi Buana University Surabaya along with this progress has designed a special LMS with the name VIRLENDA. Virlenda is in carrying out a learning process that is not the same as other LMS on the internet such as Google Classroom. This LMS is specifically designed to bridge the learning process in the PGRI Adi Buana University Surabaya. In the LMS Virlenda has been made complete and detailed how to accommodate lectures to help students lecture comfortably with easy access or easy to follow. Virlenda is designed by prioritizing easy access for students and lecturers so that the learning process can be carried out properly. This opportunity to create real-life learning experiences and promote student collaboration as they acquire and strengthen skills of independence, and self-management are among the skills students need for lifelong learning that they can apply across disciplines and global law environments (Ian McCall, 2020). There are several factors that can be considered when using LMS for teaching and learning purposes, namely attitudes towards using LMS, factors related to the environment around faculty members and its characteristics that encourage or hinder faculty members to use LMS. become more critical of the effect of using LMS (Asiri & Mahmud, 2012).

This study provides the necessary insight into how a particular mode of learning delivery is a key factor in sustaining student learning performance and promoting lifelong learning. Shakeel. Qureshi (2011) The most desirable teaching methods that need to be supported by LMS are group problem solving, discussion-based strategies, problem-based learning, and simulations. I Ketut Darma at.al. (2019), the Blended learning model supported by multimedia learning media improves performance assessment based on portfolio and self-assessment. Sofia at.al. (2015) LMS system under mixed learning modality can efficiently support Online Learning Environment in Higher Education Institutions.

This learning model that has many benefits invites all lecturers to use the blended learning model as a forum and form of learning in the future. This reason cites the opinion of Fatirul (2020) that the teacher's task is not finished after the teacher conducts face-to-face learning, but to facilitate the learning of their students, they can continue with online learning. Besides this model has an impact on students in their learning, it will also be able to improve abilities and make it easier for lecturers to carry out their learning processes such as being able to create more effective, efficient, and interesting learning patterns according to the interests of students and can improve teaching skills for teachers in dealing with different students. Hasmunarti: 2018, Jong at.al.: 2016, Donnelly: 2010). This clarity indicates that the learning process can be carried out using a blended learning model, so that with a blended learning model our students will further increase communication and collaboration activities among friends, satisfaction (Donnelly: 2010, Jong at.al.: 2014).

This problem-based learning strategy will expand the use and increase the accessibility, flexibility, and comfort that students expect from higher education in the digital era so that students can feel satisfied in carrying out the learning process (Hazwanie, 2017,). With the problem-based learning strategy that we use, it will save learning time so that learning can be more effective, think creatively and critically (Manwa at.al, 2013, Donnelly, 2010, Yun-Jo at.al., 2013).

## METHOD

This research is development research that aims to develop learning tools with a blended learning model based on Virlenda by using problem-based learning strategies to improve students' thinking skills. The research model uses the Borg and Gall research model (1983) while product development is carried out using a learning system development model with the Dick and Carey model (2001).

This research was conducted on undergraduate students at PGRI Adi Buana University Surabaya on undergraduate students of English, Physical Education and Elementary School Teacher Education with a total sample of 399. The trial was conducted by involving 2 learning design experts, 2 material experts, 2 media experts, and 2 peers. Meanwhile, to test the feasibility of the developed product, it was carried out on 10 students as a small group trial. Limited group trials were conducted on 65 students. Meanwhile, the field trial group was carried out on 100 students.

The data collection was carried out using a questionnaire which included a questionnaire for all test subjects including expert validation. This questionnaire was prepared by containing several aspects regarding ease of access, strategies used and attractiveness. Data analysis will be carried out using descriptive statistics of percentages, while to determine the level of proficiency in student thinking is done by looking at the application of the old model by using the Learning Management System with Google Classroom. Learning outcomes will be seen from the test results of each model used.

## FINDINGS

### Design Expert Test

**Table 1. Validation Results of 2 Design Experts**

| No. | Aspect | Number of Items | Aspect Percentage | Percentage of Total Aspect |
|---|---|---|---|---|
| 1 | Material Serving Design | 5 | 84,6 % | 85,8% |
| 2 | There are Instructions for Each Material Serving | 5 | 86% | |
| 3 | Material Suitability with PBL Strategy | 4 | 88% | |
| 4 | Material Serving Density | 3 | 86,7% | |
| 5 | Conformity of Evaluation with PBL Strategy | 3 | 84 % | |
| | Total | 20 | | |

The validation results from 2 design experts from 5 aspects measured were obtained for the material presentation design aspect to get a percentage of 84.6%, for the instructional aspect of each material presentation a percentage of 86%, for the aspect of the suitability of the material with the PBL learning strategy a percentage of 88%, for The aspect of the density of the material presented obtained a percentage of 86.7% and for the aspect of the suitability of the evaluation with the PBL learning strategy it was 84%. The total assessment of the developed product obtained a percentage of 85.8%, this indicates the product developed is feasible to be used in the learning process.

### Material Expert Test

**Table 2. Validation Results of 2 Material Experts**

| No. | Aspect | Number of Items | Aspect Percentage | Percentage of Total Aspect |
|---|---|---|---|---|
| 1 | Serving Material Density | 5 | 86 % | 86,5% |
| 2 | Compatibility of Material with PBL Strategy | 5 | 84 % | |
| 3 | The Confusion of Serving Materials | 5 | 89% | |
| 4 | Conformity of Evaluation with PBL Strategy | 5 | 87% | |
| | Total | 20 | | |

The validation results from 2 material experts from 4 aspects measured were obtained for the aspect of material presentation density obtaining a percentage of 86%, for the aspect of the suitability of the material with the PBL learning strategy a percentage of 84%, for the convoluted aspect of the presentation material a percentage of 89%, and for the evaluation suitability aspect with the PBL learning strategy obtained 87%. The total assessment of the developed product obtained a percentage of 86.5%, this indicates the product developed is feasible to be used in the learning process.

**Media Expert Test**

**Table 3. Validation Results of 2 Media Experts**

| No. | Aspect | Number of Items | Aspect Percentage | Percentage of Total Aspect |
|---|---|---|---|---|
| 1 | Virlenda's Design | 5 | 89% | 87,7% |
| 2 | Complete menu Virlenda | 5 | 88 % | |
| 3 | Ease of Access | 5 | 88% | |
| 4 | Virlenda's Fascination | 5 | 86% | |
| | Total | 20 | | |

The validation results from 2 media experts from 4 aspects measured were obtained for the virlenda design aspect, obtaining a percentage of 89%, for the aspect of completeness of the virlenda menu, it obtained a percentage of 88%, for the ease of access aspect, the percentage was 88%, and for the attractiveness aspect of virlenda, it was 86%. The total assessment of the developed product obtained a percentage of 87.7%, this indicates the product developed is feasible to be used in the learning process.

**Peer Test**

**Table 4. Validation Results of 2 Colleagues**

| No. | Aspect | Number of Items | Aspect Percentage | Percentage of Total Aspect |
|---|---|---|---|---|
| 1 | Completeness of Serving Materials | 5 | 86 % | 86,5% |
| 2 | The Confusion of Serving Materials | 5 | 89 % | |
| 3 | Conformity of Evaluation with PBL Strategy | 5 | 84% | |
| 4 | Attractiveness | 5 | 87% | |
| | Total | 20 | | |

The validation results from 2 colleagues from the 4 aspects measured were obtained for the aspect of completeness of the material presentation to obtain a percentage of 86%, for the aspect of the continuity of the presentation material a percentage of 89%, for the aspect of conformity with the evaluation of the PBL learning strategy a percentage of 84%, and for the attractiveness aspect, it was obtained 87%. The total assessment of the developed product obtained a percentage of 86.5%, this indicates the product developed is feasible to be used in the learning process.

**Small Group Trial**

**Table 5. Small Group Trial Results**

| No. | Aspect | Number of Items | Aspect Percentage | Percentage of Total Aspect |
|---|---|---|---|---|
| 1 | Virlenda's Fascination | 5 | 83,7 % | 82,7% |
| 2 | Ease of Access | 5 | 84,9% | |
| 3 | Clarity of Serving Material | 4 | 83% | |
| 4 | The Attractiveness of the Display of Material | 3 | 82% | |
| 5. | The Attractiveness of Problem Based Evaluation | 3 | 80% | |
| | Total | 20 | | |

The results of the trial in a small group with a total of 5 respondents from 5 aspects measured were obtained for the attractiveness aspect of virlenda obtaining a percentage of 83.7%, for the ease of access aspect a percentage of 84.9%, for the aspect of clarity of the material presented a percentage of 83%, for the aspect of The attractiveness of the presentation of the material received a percentage of 82%, and for the attractiveness aspect of the problem-based evaluation it was 80%. The total assessment of the developed product obtained a percentage of 82.7%, this indicates the product developed is feasible to be used in the learning process in trials in moderate or limited groups.

**Medium Group Trial**

**Table 6. Test Results for the Moderate/Limited Group**

| No. | Aspect | Number of Items | Aspect Percentage | Percentage of Total Aspect |
|---|---|---|---|---|
| 1 | Virlenda's Fascination | 5 | 90 % | 89,6% |
| 2 | Ease of Access | 5 | 89% | |
| 3 | Clarity of Serving Material | 4 | 89% | |
| 4 | The Attractiveness of the Display of Material | 3 | 90% | |
| 5. | The Attractiveness of Problem Based Evaluation | 3 | 90% | |
| | Total | 20 | | |

The results of the trial in the moderate or limited group with a total of 5 respondents from 5 aspects measured were obtained for the attractiveness aspect of virlenda, it obtained a percentage of 90%, for the aspect of ease of access, it was 89%, for the aspect of clarity of the presentation material, it was obtained a percentage of 89%, for the aspect of display attractiveness. the presentation of the material obtained a percentage of 90%, and for the aspect of attractiveness the problem-based evaluation obtained 90%. The total assessment of the developed product obtained a percentage of 89.6%, this indicates the product developed is feasible to be used in the learning process in large group trials.

**Large Group Trial**

**Table 7. Large Group Trial Results**

| No. | Aspect | Number of Items | Aspect Percentage | Percentage of Total Aspect |
|---|---|---|---|---|
| 1 | Virlenda's Fascination | 5 | 91 % | |
| 2 | Ease of Access | 5 | 92% | |
| 3 | Clarity of Serving Material | 4 | 90% | 92% |
| 4 | The Attractiveness of the Display of Material | 3 | 94% | |
| 5. | The Attractiveness of Problem Based Evaluation | 3 | 93% | |
| | Total | 20 | | |

The results of the trial in a large group with a total of 5 respondents from 5 aspects measured were obtained for the attractiveness aspect of virlenda, a percentage of 91% was obtained, for the ease of access aspect, a percentage of 92% was obtained, for the aspect of clarity of presentation material, a percentage of 90% was obtained, for the aspect of the attractiveness of the presentation of the material. obtained a percentage of 94%, and for the attractiveness aspect of the problem-based evaluation obtained 93%. The total assessment of the developed product obtained a percentage of 92%, this indicates that the product developed is feasible to be used in the learning process. This product can be mass-produced to be known and used as a guide in carrying out the learning process, thus it can also be said that the development of blended learning with problem-based learning strategies to improve students' thinking skills in facing the world of work can be used as guidelines in the use of learning models and strategies. For large group trials, experiments were also conducted to determine the effectiveness of students' thinking skills between the old model and the new model. From the experimental results obtained as in table 8 below:

**Table. 8. Comparative Test Results of the LMS-Virlenda Group and the LMS-Google Classroom Group.**

| | Group | N | Mean | SD | SE |
|---|---|---|---|---|---|
| Hasil | Google Classroom | 100 | 74.500 | 4.576 | 0.458 |
| | Virlenda | 100 | 85.450 | 9.159 | 0.916 |

From table 8 it is shown that SE for Virlenda produces a value of 0.916 and for Google Classroom gets a value of 0.458. This indicates that the effectiveness in terms of problem-solving skills for LMS Virlenda students is significantly better than LMS-Google Classroom.

## DISCUSSION

All the results carried out in this study received very positive responses from all experts, lecturers, and students. All designs developed also have a main place for students who can carry out the learning process easily. This indicates that the demands of the KKNI-based curriculum in Indonesia developed in universities are the main requirements and have a close relationship with the designs that are made very supportive of the demands of the curriculum and the demands of the 21st century in the industrial era 4.0, so that later it is hoped that the mastery of student competencies is in accordance with the demands of the world. work. This becomes very important for students to be able to communicate and collaborate with teachers when students find difficulties in understanding the learning material provided by the teacher so that it can also improve the ability to solve problems for students. To facilitate communication and collaboration in the learning process, teachers and students are facilitated by using WhatsApp groups to bridge and provide information from lecturers. Of course, the above is not enough, students in online learning can express their search for knowledge in all sources on the internet. This learning prioritizes diversity in problem solving given by the teacher.

The learning process in the 21st century, whether there are world events about the Covid-19 virus that is developing or the absence of these events, learning should refer to the learning process that refers to the blended learning model, but no matter how good the learning model is if it is not supported by the right learning method or strategy then what happens is an ineffective learning process. In accordance with this, to support graduates with the world of work is very much needed. What it means is that the theory presented is not applied to real problems that are developing. Therefore, the right method or strategy is to use problem

based learning strategies. Besides being the demands of the 21st century and the demands of the curriculum, problem based learning strategies bring benefits to students about their way of thinking, communication and collaboration models, and can improve problem solving skills in the field.

The model presented is using a problem-based learning strategy, all materials that will be presented to students of course require a forum for students to get all the materials presented by the lecturer. Learning Management System is a development in the world of technology that has developed for a long time, but often universities in Indonesia do not use it well. There are many learning management systems available on the internet, such as Google Classroom and so on. Can this LMS bridge the implementation of the learning process in higher education? With this demand, Universitas PGRI Adi Buana Surabaya designed a learning management system that is oriented towards convenience by studying the available LMS according to student needs. This learning management system is named Virlenda. PGRI Adi Buana University Surabaya will make the university a digital campus. This is the basis for designing the LMS Virlenda to make it happen and according to the recommendations of the 21st century and the demands of the curriculum in Indonesia.

As an appeal that universities everywhere can design a learning management system independently to accommodate the learning process properly. Several studies that support this research have been produced on LMS, blended learning and problem-based learning.

There are many benefits of using LMS from previous research conducted by Norhaiza Khairudin at.al. (2016), Aparecido Fabiano at.al. (2008) that with LMS learning will be more effective and to help increase IT knowledge among lecturers. And online learning effectively and supports student communication in the learning environment. Student participation in collaborative and interactive learning, academic integrity and the degree of student interaction and involvement in the distance learning process are all considered important criteria in making the decision to adopt an LMS. Another study by Hamzarudin Hikmatiar at.al. (2020), Oka Agus Kurniawan Shavab at.al. (2018) with the use of LMS, many students received positive responses. and have a good impact on learning outcomes. LMS shows a very good average validation, so it can be said that it is feasible as a learning medium. Another case is done by Mohammed at.al. (2012), Untung Raharja at.al. (2016), Natasa Hoic-Bozic at.al (2009) that LMS can improve the quality of learning. Encouraging students to be more interactive, eliminating the limitations of time and space in the learning process and with LMS will improve learning outcomes and can participate in learning process activities anywhere and anytime. Therese H. Federl (2020), The use of LMS can be of interest to teachers, institutes and faculties. This can help them structure the course pages to provide a better experience for students.

Another finding about the blended learning model which is supported by previous researchers conducted by zgen Kormaz at.al (2009), Wing Sum Cheung and Khe Foon Hew (2011), the blended learning model contributes more to students' attitudes towards courses and students have more thinking Critical thinking that stands out means that the higher the student's attitude, the higher the student's way of thinking. Ron Oliver (2005), Findings from research that a problem-based teaching approach delivered using blended learning provides strong support for students, influences student satisfaction levels and can explore strategies where such settings can cater more broadly to all students in large classroom settings.

The blended learning model combined with the problem-based learning strategy of previous research can have benefits for students' abilities such as the research conducted by Siti Azizaha at.al. (2017), Stefan Moeller at.al. (2010). Student learning activities using problem-based internet media have increased student activity in learning and there is a significant difference in increasing learning outcomes between classes that use internet media and classes that do not use internet media and the Communication Quality of PBL learners is superior. Heru Raharjo at.al. (2018), Dwi & Suyanto (2019) Hadi Suwono & Ety Kumala Dewi (2019), Ikuo Shimizu1, Hideyuki Nakazawa (2019), Lamria at.al. (2018), learning outcomes using PBL have high motivation, students' higher-order thinking and improve their achievement and results. Integration of PBL with online can increase motivation, scientific communication, and high learning and creativity skills with the interaction in PBL learning strategies and Mary Beadle & Julie Santy (2008), Modules or teaching materials are delivered using a problem-based learning approach with a blended learning model to support students in the learning process.

With this support, the results of this study can lead to the benefit that the LMS which is packaged with a blended learning model and problem-based learning strategy has clearly proven that the learning process in schools or colleges anywhere can be the rationale for being able to package learning using LMS, blended learning. with a problem-based learning strategy. This will bring students to work-ready outputs.

## CONCLUSION

The blended learning model which is the focus of the learning model to develop the recommended product is one of the learning models. No matter how good the learning model is without being followed by the right learning strategy, the learning process will not be effective. The blended learning model using a problem-based learning strategy based on Virlenda that was developed is proven to be able to improve students' thinking skills more prominently than using other LMS models which in this case are based on Google Classroom. This is evidenced by the response in the use of the developed product to get a very positive response from students who get a percentage of 92% and the comparison of scores in students' thinking skills gets a better increase

in abilities than the google classroom-based model. Thus Virlenda's learning management system has been proven to be able to facilitate the implementation of the learning process at PGRI Adi Buana University Surabaya very impressively which is supported by a blended learning model using problem based learning strategies that make the learning process more effective, efficient, and attractive to students. It is an expectation that all universities wherever they are can build a learning management system independently which is designed according to the needs of each university by not forgetting to pay attention to the characteristics of each student who has a unique variety. Thus, the university can carry out the learning process independently to go to a digital campus that has potential and is oriented towards the development of science and technology.

**Acknowledgement**

We would like to thank the leadership of the PGRI University Adi Buana Surabaya for supporting this research. All experts who have provided input on the developed product, colleagues and lecturers who have helped in the learning process, as well as students who have supported as objects in this research.

**REFERENCE**

Adler, R. W., & Milne, M. J. (1997). Improving the quality of accounting students' learning through action-oriented learning tasks. *Accounting education*, 6(3), 191-215.

An, Y. J. (2013). Systematic design of blended PBL: Exploring the design experiences and support needs of PBL novices in an online environment. *Contemporary Issues in Technology and Teacher Education*, *13*(1), 61—79.

Arends, R. I. (2007). *Learning to Teach*, McGraw Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY 10020.

Asiri, M. J. S. (2012). Factors influencing the use of learning management system in Saudi Arabian higher education: A theoretical framework. *Higher Education Studies*, *2*(2), 125—137.

Azizah, S., Khuzaemah, E., & Lesmanawati, I. R. (2017). Penggunaan media internet eXe-Learning berbasis masalah pada materi perubahan lingkungan untuk meningkatkan hasil belajar siswa. *Scientiae Educatia: Jurnal Pendidikan Sains*, *6*(2), 197—213.

Beadle, M., & Santy, J. (2008). The early benefits of a problem-based approach to teaching social inclusion using an online virtual town. *Nurse Education in Practice*, *8*(3), 190—196.

Borg, W., & Gall, M. D. (2003). *Educational Research: An Introduction Seventh Edition Boston*.

Carman, J. M. (2005). Blended learning design: Five key ingredients. *Agilant Learning*, 1—11.

Chang, N., Wang, Z., & Hsu, S. H. (2020). A Comparison of the Learning Outcomes for a PBL-based Information Literacy Course in Three Different Innovative Teaching Environments. *Libri*, *70*(3), 213—225.

Cheung, W. S., & Hew, K. F. (2011). Design and evaluation of two blended learning approaches: Lessons learned. *Australasian Journal of Educational Technology*, *27*(8).

Darma, I. K., Karma, I. G. M., & Santiana, I. M. A. (2019). The Development of Blended Learning Model in Applied Mathematics by Using LMS Schoology: Requirement Analysis Stage. *International Research Journal of Engineering, IT and Scientific Research*, *5*(6), 33—45.

Dawilai, S., Kamyod, C., & Prasad, R. (2021). Effectiveness comparison of the traditional problem-based learning and the proposed problem-based blended learning in creative writing: A case study in Thailand. *Wireless Personal Communications*, *118*(3), 1853—1867.

de Carvalho, A. F. P., & Silva, J. C. A. (2008, June). The Importance of Usability Criteria on Learning Management Systems: Lessons Learned. In *ICEIS (5)* (pp. 154-159).

De Jong, N., Krumeich, J. S. M., & Verstegen, D. M. (2017). To what extent can PBL principles be applied in blended learning: Lessons learned from health master programs. *Medical Teacher*, *39*(2), 203—211.

de Jong, N., Savin-Baden, M., Cunningham, A. M., & Verstegen, D. M. (2014). Blended learning in health education: three case studies. *Perspectives on medical education*, *3*(4), 278—288.

Dias, S. B., Hadjileontiadou, S. J., Hadjileontiadis, L. J., & Diniz, J. A. (2015). Fuzzy cognitive mapping of LMS users' quality of interaction within higher education blended-learning environment. *Expert systems with Applications*, *42*(21), 7399—7423.

Ding, X., Zhao, L., Chu, H., Tong, N., Ni, C., Hu, Z., ... & Wang, M. (2014). Assessing the effectiveness of problem-based learning of preventive medicine education in China. *Scientific reports*, *4*(1), 1—5.

Donnelly, R. (2010). Harmonizing technology with interaction in blended problem-based learning. *Computers & education*, *54*(2), 350—359.

Fatirul, A. N. (2012). *The Influence of Learning Strategies (Problem Based Learning with Internet and Without Internet Assistance) and Cognitive Style on Learning Achievement.* Unpublished Dissertation. State University of Malang.

Fatirul, A. N., ST, M. P., Walujo, D. A., & ST, M. (2020). *Desain blended learning: Desain Pembelajaran Online Hasil Penelitian*. Scopindo Media Pustaka.

Federl, T. H., Hagen, F., Johansen, M. J., & Styve, S. O. (2020). The Importance of Structural Consistency in Distributed Learning Management Systems.

Gürses, A., Açıkyıldız, M., Doğar, Ç., & Sözbilir, M. (2007). An investigation into the effectiveness of problem-based learning in a physical chemistry laboratory course. *Research in science & technological education*, *25*(1), 99—113.

Hashim, H., Chong, D. W., Er, H. M., Deb, P. K., Wong, P. S., Lee, M. S., ... & Baloch, H. Z. (2017). Students' Perceptions of Live Online Virtual e-Problem Based Learning (LOVE-PBL) using Google Hangouts. *Education in Medicine Journal*, *9*(4).

Hasmunarti, H., Bahri, A., & Idris, I. S. (2019). Analisis kebutuhan pengembangan blended learning terintegrasi strategi pblrqa (problem-based learning and reading, questioning & answering) pada pembelajaran biologi. *Biology Teaching and Learning*, *1*(2).

Hidayati, N., Zubaidah, S., Suarsini, E., & Praherdhiono, H. (2020). Cognitive learning outcomes: Its relationship with communication skills and collaboration skills through digital mind maps-integrated PBL. *International Journal of Information and Education Technology*, *10*(6), 433—448.

Hikmatiar, H., Sulisworo, D., & Wahyuni, M. E. (2020). Utilization of Google Classroom-Based Learning Management System in Learning. *Jurnal Pendidikan Fisika*, *8*(1), 78—86.

Hoic-Bozic, N., Mornar, V., & Boticki, I. (2008). A blended learning approach to course design and implementation. *IEEE transactions on education*, *52*(1), 19—30.

Hong, K. H., & Samimy, K. K. (2010). The influence of L2 teachers' use of CALL modes on language learners' reactions to blended learning. *Calico Journal*, *27*(2), 328—348.

Iqbal, S. (2011). Learning management systems (LMS): Inside matters. *Information Management and Business Review*, *3*(4), 206—216.

I'zzaty, R. D. (2020, October). Verification Of Independent Study Assessment Using Blockchain Technology. In *IAIC International Conference Series*, *2*(11), 15—21.

Khairudin, N., Khairudin, R., Hamid, M. N. A., Hancock, P., McGill, T., & Zamani, Z. A. (2016). The importance of human capital perspective in the learning management system (LMS) decision making process at universities. *Jurnal Psikologi Malaysia*, *30*(2).

Korkmaz, O., & Karakus, U. (2009). The impact of blended learning model on student attitudes towards geography course and their critical thinking dispositions and levels. *Turkish Online Journal of Educational Technology-TOJET*, *8*(4), 51—63.

Lukitasari, M., Purnamasari, I., Utami, S., & Sukri, A. (2019). Blended-Problem-Based Learning: How its impact on students' critical thinking skills?. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *5*(3), 425—434.

Mahardika, I. K., Harijanto, A., & Winata, M. S. (2017). Fluid dynamic learning assisted by student worksheet based RVM with setting PBL. *The International Journal of Social Sciences and Humanities Invention*, *4*(8), 3830—3833.

McCall, I. (2010). Online enhanced problem-based learning: assessing a blended learning framework. *The Law Teacher*, *44*(1), 42—58.

Moeller, S., Spitzer, K., & Spreckelsen, C. (2010). How to configure blended problem based learning–Results of a randomized trial. *Medical Teacher*, *32*(8), 328—346.

Ng, M. L., Bridges, S., Law, S. P., & Whitehill, T. (2014). Designing, implementing and evaluating an online problem-based learning (PBL) environment–A pilot study. *Clinical linguistics & phonetics*, *28*(1-2), 117—130.

Ogara, D. O., & Suyanto, S. (2019). Comparison of Learning Outcomes Between Using PBL And TAI Viewed From Student's Motivation. *JPP (Jurnal Pendidikan dan Pembelajaran)*, *26*(1), 1—9.

Oliver, R. (2005). Using a blended learning approach to support problem-based learning with first year students in large undergraduate classes.

Raharjo, H., Khairudin, M., & Abd Baser, J. (2018). The influence of problem-based learning and direct teaching on students' learning outcomes. *Jurnal Pendidikan Teknologi dan Kejuruan*, *24*(1), 62—71.

Shavab, O. A. K. (2017). Model Pembelajaran Value Clarification Technique (VCT) dengan Memanfaatkan Learning Management System (LMS) Berbasis Edmodo dalam Pendidikan Nilai pada Pembelajaran Sejarah. In *Prosiding Seminar Nasional Pendidikan FKIP* (Vol. 1, No. 2).

Shimizu, I., Nakazawa, H., Sato, Y., Wolfhagen, I. H., & Könings, K. D. (2019). Does blended problem-based learning make Asian medical students active learners?: a prospective comparative study. *BMC medical education*, *19*(1), 1—9.

Smaldino, S. E., Lowther, D. L., & Russell, J. D. (2011). *Teknologi Pembelajaran dan media untuk belajar*. Jakarta: Kencana Prenada Media Group.

Surur, M., Degeng, I., Setyosari, P., & Kuswandi, D. (2020). The Effect of Problem-Based Learning Strategies and Cognitive Styles on Junior High School Students' Problem-Solving Abilities. *International Journal of Instruction*, *13*(4), 35—48.

Suwono, H., & Dewi, E. K. (2019, March). Problem-based learning blended with online interaction to improve motivation, scientific communication and higher order thinking skills of high school students. In *AIP Conference Proceedings* (Vol. 2081, No. 1, p. 030003). AIP Publishing LLC.

Tambunan, L., Rusdi, R., & Miarsyah, M. (2018). Efectiveness of Problem Based Learning Models by Using E-Learning and Learning Motivation Toward Students Learning Outcomes on Subject Circullation Systems. *Indonesian Journal of Science and Education*, *2*(1), 35—43.

Wheeler, S., Kelly, P., & Gale, K. (2005). The influence of online problem-based learning on teachers' professional practice and identity. *ALT-J*, *13*(2), 125—137.

Woltering, V., Herrler, A., Spitzer, K., & Spreckelsen, C. (2009). Blended learning positively affects students' satisfaction and the role of the tutor in the problem-based learning process: results of a mixed-method evaluation. *Advances in Health Sciences Education*, *14*(5), 725—738.

Yu, W. C. W., Lin, C. C., Ho, M. H., & Wang, J. (2015). Technology Facilitated PBL Pedagogy and Its Impact on Nursing Students' Academic Achievement and Critical Thinking Dispositions. *Turkish Online Journal of Educational Technology-TOJET*, *14*(1), 97—107.