Schoology based applied mathematics blended learning model to improve the students’ problem-solving ability

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Abstract. This study aims to determine the feasibility of a model of blended learning applied mathematics using schoology for vocational education using the 4D model development method that includes the four Ds steps, namely Define, Design, Develop, and Disseminate. The research was conducted at the Politeknik Negeri Bali where the data were collected using a validation sheet and student response questionnaire sheet. Data were analyzed descriptively. As a result, the design of applied mathematics blended learning using schoology achieved: feasibility level of 84.91% (feasible), practicality 78.84% (practical), and the compliance was 88.02% (very helpful). This implies that blended learning applied mathematics is very appropriate to be used as a model of learning in vocational education. The design development can be continued to the stage of effectiveness testing, evaluation and dissemination.

1. Introduction

Vocational learning is contextual learning related to the world of work, authentic with a socio-cultural scientific technological approach [1]. The learning process is faced with the real challenges of the need to develop work competency capabilities in the new world of work in the 21st century. Job competence capabilities are determined by four main aspects, namely: (1) work skills, (2) work knowledge, (3) work attitudes, and (4) work morale.

A person's work capability is determined by the capacity of skills: motor, intellectual, and mental skills in carrying out work tasks. One of the key skills determining a person's work competency capability in the 21st century is the ability to solve problems creatively, using critical thinking. Problem solving abilities can be developed through learning mathematics in accordance with the 21st century learning paradigm.

Learning mathematics is one of the components of education that contributes to the development of science and technology [2]. Mathematics is one of the compulsory subjects of vocational education. Mathematics learning in the 21st Century is learning that emphasizes the importance of developing on 4 aspects (4C), namely creativity, critical thinking and problem solving, collaboration and communication skills [3]. The learning paradigm of the 21st century emphasizes the ability of students to think critically, to connect knowledge with the real world, to master information technology, to communicate and to collaborate [4].
Problem solving is a competency shown by students in understanding problems, choosing solving approaches and strategies, and solving models to solve problems [5][2]. Problem solving ability is one of the highest skills and is called higher order thinking, because the results of the solution contain thinking skills, collaboration, communication, and others [6]. Problem-solving abilities receive great attention from education observers and teachers and are even referred to as skills that must be mastered in the 21st Century [7]. Even the National Council of Teachers of Mathematics (NCTM) recommends problem solving should be the focus of learning mathematics at every level of education [8][2]. However, the ability of students in Indonesia is still low [9]. To facilitate students to achieve these skills, strategies and tools that are that are in line with the mathematics learning paradigm of the 21st Century are needed. One of them is optimizing the use of information and communication technology (ICT), such as the internet in learning [10].

ICT in education can make it easier for teachers to carry out knowledge transfer activities quickly, easily, without any time and space restrictions [11]. One of the forms of information technology that can be used in educational activities is electronic learning (e-learning). E-learning is an innovation that can be used in the learning process, not only in the delivery of learning material but also changes in the abilities of various competences of students. Through e-learning, students do not only listen to material descriptions from educators but also actively observe, do, demonstrate, and so on.

E-learning is a learning technology that plays an important role for students to access distance learning [12] (Nortvig, 2014). E-learning is also used as a very useful source of online information because e-learning does not have to be face-to-face [13]. E-learning is used as independent learning for students [14]. E-learning is very easy to use [15].

Initially, the use of e-learning was superior compared to conventional face-to-face learning. Using e-learning media can be more open, flexible and can happen anytime, anywhere, with anyone. In essence, e-learning encourages a change in the educational paradigm from teacher centered learning to student centered learning. But to lead to the implementation of 100% e-learning, the readiness of human resources is one of the challenges. Indonesian society is often able to provide infrastructure, but the optimization of the tools and its sustainability effects are still questionable.

The biggest obstacles of e-learning is to create direct interactivity between students and their instructors, because learning is a two-way process [16]. Students need feedback from the teacher, and vice versa: the teacher also needs feedback from students. Through this method, learning outcomes will be obtained that are more effective, right on target. Another obstacle, namely the various regional conditions in Indonesia, causes not all areas to be covered by internet services and the distribution of internet networks is slow at times [17]. The other problem is the ability of the parents to provide online education facilities [18]. Additionally, the use of the internet network costs money [19][20]. One of the ways to improve services that educators / teachers can do during the era of ir. 4.0 is to develop blended learning [10]. Developing blended learning-based courses is in line with unique challenges, namely technology, learning strategies, new ways of communicating, and assessment [10].

Hybrid, or blended learning, courses are defined as classes in which instruction takes place in a traditional classroom setting augmented by computer-based or online activities, which can replace classroom seat time [21]. Blended learning is an approach that integrates face-to-face teaching and computer-assisted instructional activities (computer-mediated instruction) in a pedagogic environment [22]. Blended learning combines the best aspects of online learning, structured face-to-face activities, and real-world practice [23].

The development of the blended learning model will encourage the acceleration of students’ information and knowledge, so that it will enhance effective learning. Effective learning can form an active and productive learning atmosphere for students [24]. Learning in higher education requires students to be active in developing material obtained from lecturers at face-to-face and outside lectures. The development of web-based blended learning demands that learning is not only focused on class hours, but learning will continue outside the classroom with online media in web-based media.

Blended learning combines various delivery media designed to complement each other and encourage an optimal learning process [25][26]. The main objective is to get the “best” learning by
combining the various advantages of each component where conventional methods allow for interactive learning while online methods can provide material online without time and space limitations so that the maximum learning process is achieved [10]. Another objective is to provide opportunities for the students’ varied characteristics to occur independently, sustainably and develop throughout life, so that learning will be effective, more efficient and more interesting [27]. Blended learning will also help students to develop better in the learning process, according to their respective learning styles and preferences; provide practical and realistic opportunities for educators and students in independent learning; make learning more useful and meaningful for students; as well as helping the independent soul of students in learning.

Implementing blended learning requires an application, namely the learning management system (LMS). LMS is a software application or web-based technology that is used to plan, implement, and assess the learning process [28][29]. Several types of LMS are often used in the learning process, including: Schoology, Learnboos, Edmodo, Moodle and others. Schoology in school is to connect school community in the technology supported classroom improving student learning [30]. Schoology is the same as other LMS applications, its advantages are in several figures and can be entered into the system with the link: www.schoology.com. Schoology figures include courses, groups, and resources [31][32], which can help lecturers, who cannot teach in the classroom, by providing online learning materials. Schoology supports the team teaching learning model. Lecturers can easily invite other lecturers to become co-teachers, by giving another code with the parent code given to students. Specifically, Schoology can be used as a medium for interacting with symbols, equations, latex. So that the types of questions that are supported by images, symbols, and equations can be written in Schoology [33][32][31]. It is very suitable to be used as a medium for learning mathematics.

According to Mahanani, with schoology, lecturers can hone the mindset of students to think critically and creatively [34]. E-learning with schoology media, the presentation of the material can initiate students activities to compete with friends and actively participate in solving problems presented by lecturers [35]. Learning using schoology can increase student activity and learning outcomes [36], and can also solve problems in learning on campus through communication. Sicat's research results show that Schoology is effectively used to implement blended learning [37]. Joshua proved that there was an increase in the high category for the motivational aspects of students who were taught using Schoology [38]. There is a significant difference in the use of E-learning Schoology learning media and conventional learning media, where the learning outcomes of students who are taught using E-learning Schoology learning media are better with a higher average learning outcome [39].

This study aims to obtain a blended learning design of applied mathematics using the schoology application implemented in stages over 3 stages of time. The first stage has already provided a draft of the blended learning design. Currently, the product development and testing stages are being carried out. The aim is to determine the feasibility level of applied mathematics belnded-based learning design.

2. Research Methods
This research is a development research using the 4-D model from Thiagarajan, Semmel and Semmel [40]. The development procedure includes the 4 steps, namely 1) Define, 2) Design, 3) Develop, and 4) Disseminate. Implementation in the field of engineering at the Bali State Polytechnic (BSP), for 3 years. The subjects are students and teachers of applied mathematics in the engineering sector of the Bali State Polytechnic. The sample of students is distributed in 3 departments and 6 study programs. The number of samples is taken using purposive sampling according to the needs of the research stage.

The Define and Design stage is the stage of needs analysis and development planning. The goal is to determine requirements, describe development needs, and get a prototype developed. This stage has been carried out in year I (2019) and has received a prototype draft I of the blended learning model for applied material.

The development stage consists of carrying out expert tests and trials of draft I to get a validated draft II of the blended learning design. This stage is carried out through: 1) expert appraisal, 2) revision, 3)
developmental testing. The assessment was carried out by filling out a validation questionnaire on the design aspects of draft I and filling out the student response questionnaire to draft II.

The dissemination stage is the use of learning models that have been developed on a broader scale such as other classes and other teachers. The goal is to test the effectiveness and evaluation of learning models in learning activities, which will be carried out in the next stage in the 3rd year (2021).

Data were collected using validation sheets and student responses. Furthermore, the data were analyzed using quantitative descriptive statistics. The analysis of the results of the validation was carried out by the validator and the student responses were determined from the average percentage of the validity score using the following formula.

\[ SV = \frac{Sr}{Sm} \times 100\% \]  \hspace{1cm} (1)

SV and Sr are the average percentage of the validation result score and the average validation score of each validator, while Sm is the maximum score that can be obtained [41]. The level of feasibility of the model is seen from the results of expert validation and student responses to the model design. Furthermore, it is compared with the validation criteria as in Table 1 below. [42][43].

| No | Score Achievement (%) | Level of validity | Explanation |
|----|------------------------|-------------------|-------------|
| 1  | 25.00 – 40.00          | Not valid,        | may not be used |
| 2  | 41.00 – 55.00          | Less valid        | may not be used |
| 3  | 56.00 – 70.00          | Quite valid       | may be used after major revisions |
| 4  | 71.00 – 85.00          | Valid             | may be used after minor revisions |
| 5  | 86.00 – 100.00         | Very valid        | very good to use |

3. Results and Discussion
This research is a development research which was carried out for 3 years. The first stage of the year (2019) has obtained a product prototype of draft I of the blended learning applied mathematics model. The components, 1) online learning, 2) face-to-face learning, 3) independent learning, 4) application, 5) tutorials, 6) cooperation, and 7) evaluation. Its development is based on learning theory: Behaviorism, Humanism, Cognitiveivism, and Constructivism [16]. Composition between face-to-face learning and online learning 70/30 [17] [18] [19]. The combination in synchronous and asynchronous learning settings refers to the concept of 4 quadrants of learning settings [18] [20] [44]. Learning uses a problem-based learning approach.

The syntax of the Blended Learning Applied Mathematics model is designed by taking into account the views of behavioralistic, humanism, cognitive and constructivist paradigms. The social system implicit in the blended learning model is the synchronization of interactions between lecturers and students. Interaction occurs when the lecturer advises students to access the learning website, so the students do or access the learning web. The principle of reaction is a guideline for lecturers to appreciate and respond to stimuli in the form of student behavior in the learning process. The principle of reaction is a guideline for lecturers to appreciate and respond to stimuli in the form of student behavior in the learning process, namely: 1) creating a conducive atmosphere for learning, 2) providing and managing learning resources; 3) conveying information about e-learning; 4) guiding students to learn and guide solving problems; and 5) appreciating and directing all student activities during the learning process. Lecturers as facilitators, motivators, moderators and consultants[45]. Support system includes computer units, networks, students' ability to access learning webs, semester study plans (SSP), learning media and evaluation sheets. The learning web was developed using the Learning Management System (LMS) schoology model. Other supporting systems needed are 1) teaching materials; 2) e-SAS and 3)
assessment instruments, and 4) e-learning media [46]. Expected instructional impact are mastery of applied mathematics textbook material; a positive attitude towards textbooks, the learning outcomes achieved, and the ability to construct knowledge, seen from test answers and during face-to-face discussions and online learning through online discussion activities. While the accompanying impact cover independent learning, learning motivation, and increased learning activeness.

Blended learning applied mathematics is designed for one semester with a total of 2 credits, using the LMS schoology model application, can be visited via the page of www.schoology.com. The main menu display: Upgrade, Courses, Groups and Resources. Courses as a facility to create class subjects. Group facilities to create groups. While Resources are a part to place learning materials or resources. In the Courses menu, there is a material courses sub menu as a place to make various needs in the learning process and assessment of learning outcomes. Course material consisting of assignments, tests/quizzes, files and links external tools, discussions, pages, and media album (Nuhroha, 2020; Ariyani, 2020; Rohman, 2017[33][34][31]. The display draft of applied mathematics online learning uses the LMS schoology model as shown in Figure 1.

![Figure 1. Draft Online Learning Applied Mathematics Using Schoology.](image)

Currently the 2nd year stage is being carried out, namely the development stage including: expert validation and testing to get draft II. The validation of the draft I begins with the development stage through designing a blended learning model in the form of a draft guide containing the background, concepts and characteristics of the learning model which consisting of syntax, social systems, reaction principles, support systems, instructional impacts, and accompaniment impacts [42][43]. Expert validation: 1) validation of learning experts, material content, media, and design; and 2) user validation. The summary of the validation results from experts, users and audiences is presented in Table 2 below.
| No | Experts/Users          | Average | Percentage (%) | Category   |
|----|------------------------|---------|----------------|------------|
| 1  | Learning               | 3.32    | 82.95          | Valid      |
| 2  | Content of learning material | 3.6  | 90          | Very valid |
| 3  | Media                  | 3.4     | 84.3           | Valid      |
| 4  | Design                 | 3.2     | 80.3           | Valid      |
| 5  | Users                  | 3.5     | 87             | Very valid |
|    | Average                | 3.4     | 84.91          | Valid      |

The score of the assessment results from the five validators shows that the first draft of the Blended learning model was valid (84.91%) and could be used for learning applied mathematics after minor revisions were made. The revision, especially in the statement items explaining the background of the model and the learning steps, was considered less valid because it obtained an average of 2.67. In addition to the background, there is also the addition of learning theory that underlies the learning model so that the model stage actually has a theoretical basis to be applied. The learning steps are adjusted according to the PBL syntax referred to. The support system was also revised by adding an explanation of the support system that must be present in implementing the model. The development objectives are also more specified with the instructional impact. Input from the validator is used as the basis for making revisions to achieve the feasibility of the learning model.

The results of the revision of Draft I are referred to as draft II, followed by the small group test and large group test stages. Small group and large group tests are carried out in the field engineering Bali State Polytechnic. Small group and large group tests were conducted in the field of BSP engineering from January to February 2020. The small group test involved 9 students with low, medium, and high qualifications from each study program. While the large group test involved 27 students who were distributed in each study program. The recapitulation of student response in the two stages of the test shows that the percentage of average scores obtained were 75.57% and 78.84%, categorized as quite practical. This means that the web schoology of applied mathematics learning that was developed is quite feasible and practically used by the users. Furthermore, after making minor revisions on the parts that received low responsed, a limited trial was carried out. The goal is to find out the feasibility of the learning model. The limited trial involved 196 students in each engineering study program.

During a limited trial, data were collected using a student activity observation sheet instrument. Observations were carried out during the trial process when face to face takes place. The goal is to determine the feasibility of the model through student activities that appeared when the web schoology of mathematics learning is implemented. The recapitulation of the student results analysis is presented in Table 3.
Based on Table 3 the percentage of limited trial implementation is quite high, namely 88.02%. This is in line with the student activities that most appear when the students asking questions, discussing in groups and they are very confident during the limited trial of web schoology in applied mathematics learning. The lowest activity is that students do not make summaries during the trial phase. This condition description is in line with the role of the internet as a learning resource, in which learning using the web allowed students to be able to access material from anywhere without having to make a summary in a notebook [23].

During a limited trial, deficiencies and errors in the use of the web schoology of mathematics learning were found. These errors and shortcomings include user name errors and organizing the material. There are several layouts in web design that do not match the actual appearance of web design for some laptops, student skills in writing mathematical symbols with equation, and file storage. In addition, there are also some inputs from students, such as attractiveness of colors and types of questions available. Based on the shortcomings and inputs obtained, the applied mathematics schoology web was revised again therefore it can be produce a very valid and practical web.

The results of validation and testing show that the model developed is quite feasible, practical and useful to use. The blended learning model using schoology in this applied mathematics course has fulfilled the learning aspects, namely: feasibility, practicality, and utility. The model design still needs to be revised before proceeding to the stage of the effectiveness test and evaluation process at the stage of the following year.

The blended learning model developed by learners uses a problem-based learning approach, combining face to face meetings with online learning assisted by schoology applications. The learning process will be able to provide ample opportunities for students to be active and constructive. The use of this model will be able to make students creative and critical in using technology in learning. Their insights become broader and reference for solving problems becomes wider. This model can balance weaknesses by combining traditional learning methods and online learning [47]. Face-to-face learning allows for interactive learning while online learning can provide online material without time and space limits so that maximum learning can be achieved [48]. Giving problems during learning can encourage students to explore curiosity and detail on all problems and concepts in the given problem [49]. This can increase the level of learning interaction and learning activities between students and lecturers, in the end it can increase knowledge collaboration between students and teachers, and improve problem solving skills. So that the effective application of the blended learning model of applied mathematics will be able to encourage improving the ability to solve math problems for students. These results strengthen support for research results from Manggabari, Sugianti, & Masri (2016); Kholifah, & Budijjahanto (2016); Sudiarta and Sadra, 2016; and Imam, Ayubi, & Bernard (2018) [50][51][52][53].

The 21st century vocational learning is learning the development of work competency capabilities of students who are ready to solve various problems in society and the world of work. The learning must include learning experiences for developing work capabilities and working habits in the digital era, the era of disruption, welcoming the industrial revolution 4.0. The learning concept is based on the learning theory of behaviorism, cognitivism, constructivism, life-based learning, transformative, and social partnership learning [1]. Education is required to always be able to adapt to changing conditions, technology and the demands of the world of work. The curriculum integrates new competencies and literacy that are relevant to the world of work in the industrial revolution era 4.0. Learning models and modes need to be flexible, applying face-to-face learning as well as those based on information technology to build students into independent learners. Success in achieving learning goals in education does not only depend on the quality of the curriculum that has been compiled [54][55]. Success in achieving learning outcomes will be determined by the design of an appropriate learning process in accordance with the characteristics of vocational education. Along with the rapid use of ICT in the learning process, currently the learning method is not only done face to face but it can also be done online, and can even be done by combining face-to-face and online which is known as Blended learning [56]. Learning that is supported by online learning methods can have a positive influence on increasing student motivation and therefore can have a positive effect on academic success[57]. Blended learning
is very suitable for encouraging collaborative and constructive learning which is highly emphasized on current learning styles [58]. The blended learning model of applied mathematics using schoology which is being developed greatly contributes to efforts to improve the quality of learning in vocational education.

Blended learning model is not only effective, efficient and attractive to students, but is able to build a learning community between students and lecturers. Blended learning can be used as an alternative type of learning that is effective, efficient and able to support learning community facilities for students [59]. The blended learning model is appropriate for use in the current learning process, especially in the era of industrial revolution 4.0. It helps when the number of lecturers is limited and the number of students is large. This model can also be used in remote classroom learning or in emergency conditions of natural disasters such as tsunamis, earthquakes, floods or the Covid-19 pandemic, because in this condition students can still access lecture materials even though they are in a different place. Blended learning is considered to be the right step to respond to current conditions and can even become an educational innovation during the Corona-19 pandemic [60]. In the New Normal Blended Learning Era, it can be an ideal learning and accurate solution. in an effort to improve learning [61][62]. The schoology-based blended learning model is the right solution in an effort to improve the quality of learning in the Covid-19 pandemic, as long as it consistently follows the health protocols set by the government.

4. Conclusion
The design of applied mathematics blended learning using schoology achieved: feasibility level of 84.91% (feasible), practicality 78.84% (practical), and the compliance was 88.02% (very helpful). Blended learning applied mathematics is very appropriate to be used as a model of learning in vocational education. The design development can be continued to the stage of effectiveness testing, evaluation and dissemination.

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References
[1] Sudira P 2018 Metodologi Pembelajaran Vokasional, Abad XXI Inovasi, Teori, dan Praktis. (Yogyakarta: YNY Press)
[2] Retnawati H 2018 Peran Pendidikan Matematika dalam Memajukan Kualitas Sumber Daya Manusia Guna Membangun Bangsa Paper dipresentasikan pada Seminar Nasional dan Lomba Matematika ke-26 di Pendidikan Matematika FMIPA Universitas Negeri Yogyakarta, Sabtu, 17 Februari 2018
[3] Wijaya Y E, Sudjimat A D & Nyoto A 2016 Transformasi Pendidikan Abad 21 Sebagai Tuntutan Pengembangan Sumber Daya Manusia di Era Global Prosiding Seminar Nasional Pendidikan Matematika 2016- Universitas Kanjuruhan Malang. 1, 263–278
[4] Daryanto & Karim S 2017 Pembelajaran Abad 21. (Yogyakarta: Gava Media)
[5] Kemendikbud 2014 Materi Pelatihan Guru Implementasi Kurikulum 2013. (Jakarta: Pusat Pengembangan Profesi Pendidik)
[6] Gagne R M 1985 The Condition of Learning Theory of Instruction. (New York: Rinehart)
[7] Dwiyogo W 2018 Pembelajaran Berbasis Blended Learning. (Depok: Rajawali Pers)
[8] The National Council of Teachers of Mathematics 2000 Principles and Standarts for School Mathematics (United States of Amerika)
[9] Hadi S 2017 Pendidikan Matematika Realistik Teori, Pengembangan, dan Implementasinya. (Jakarta: PT. Raja Grafindo Persada)
[10] Husamah 2014 *Pembelajaran Bauran (Blended Learning): Terampil Memadukan Keunggulan Pembelajaran face-to-face, E-learning Offline-Online dan MobileLearning* (Jakarta: Prestasi Pustaka Publisher)

[11] Riyanto S dan Mumtahana H A 2018 *Desain Pembelajaran Blended Learning Untuk Kuliah Statistik* (Yogyakarta: Leutikaprio)

[12] Nortvig A M 2014 E-Learning In Poly-Topic Settings. *Electronic Journal Of E-Learning*, 12:206–214

[13] Lane S 2016 Effective Online Discussion Forums As a Legal Learning Space. *American Journal of Educational Research*, 4(3):392–396

[14] Hong N T T, Giang T T, Phuong N N, & Khanh M Q 2018 The Status of Applying E-Learning in Holding Students’ Self-Study of the Subject Education in Pedagogical Universities In Vietnam. *American Journal Of Educational Research*, 6:804–810

[15] Gloria A & Oluwadara A 2015. Pre-Service Teachers’ Ease of Use And Intention To Use Selected E-Learning Technologies in Designing Instruction. *American Journal of Educational Research*, 3:1320–1323

[16] Noer M 2010 Blended learning Mengubah Cara Kita Belajar di Masa Depan. accessed October 11, 2013 from http://www.muhammadnoer.com/2010/07/blended-learning-mengubah-cara-kita-belajar-di-masa-depan

[17] Khasanah D R A U, Pramudibyanto H & Widuroyekti B 2020 Pendidikan Dalam Masa Pandemi Covid-19. *Jurnal Sinestesia*, 10:41–48

[18] Obiakor T & Adeniran A 2020 Covid-19: Impending Situation Threatens To Deepen Nigeria ’ S Education Crisis. *Center For The Study Of The Economies Of Africa*

[19] Jones, Kevin J and Sharma R S On Reimagining a Future for Online Learning in the Post-COVID Era. accessed April 17, 2020 from https://ssrn.com/abstract=357831 or http://dx.doi.org/10.2139/ssrn.3578310

[20] Purwanto A, Pramono R, Asbari M, Santosos P B, Wijayanti L M, Hyun C C, & Putri R S 2020. Studi Eksploitatif Dampak Pandemi COVID-19 Terhadap Proses Pembelajaran Online di Sekolah Dasar. *Journal Of Education, Psychology, and Counseling*, 2:1–12

[21] Westover J H and Westover J P 2014 Teaching Hybrid Courses Across Disciplines: Effectively Combining Traditional Learning and e-Learning Pedagogies. *Jurnal International Journal of Information and Education Technology* 4:93–96

[22] Bonk C J & C R Graham 2006 *The handbook of blended learning: Global perspectives, local designs* San Francisco: Pfeiffer. Retrieved Agustus 20, 2018 from http://curtbonk.com/toc_section_intros2.pdf

[23] Semler S 2005 Use Blended learning to Increase Learner Engagement and Reduce Training Cost. Accessed Juny 1, 2013 from (http://www.learningsim.com/content/lsnews/blended_learning1.html

[24] Fry H Steve K and Stephanie M 2009 *The Handbook for Teaching and Learning in Higher Education* (New York dan London: Routledge)

[25] Khan B 2005 *Managing E-Learning Strategies : Design, Delivery, Implementation and Evaluation* (Hershey : Information Science Publishing)

[26] Piskurich G M 2006 *Rapid Instructional Design: Learning ID Fast and Right (Second Edition)*. San Fransisco (CA: Pfeiffer, John Wiley and Sons, Inc.)

[27] Rooney J E 2003 Blended learning opportunities to enhance educational programming and meetings. *Association Management* 55:26-32

[28] Sicat A S & Ed M A 2015 Enhancing College Students’ Proficiency in Business Writing Via Schoology. *International Journal of Education and Research*, 3:159–178

[29] Mahnegar F 2012 Learning Management System. *International Journal of Business and Social Science* 3:144-150

[30] Biswas S 2013 Schoology-Supported Classroom Management: A Curriculum Review, *Northwest Journal of Teacher Education* 11:187-196
[31] Rohman M F & Wahyudi D 2020 Learning Menajement System Schoology Membangun Kelas Digital Tanpa Ribet Urusan Server (Bojonegoro: Pustaka Intermedia)

[32] Nugraha T S 2020 Schoology Untuk Pembelajaran Jarak Jauh. Ciamis: Tsagqva Publishing

[33] Ariani A & Helsa Y 2019 Desain Kelas Digital Menggunakan Edmodo dan Schoology (Yogyakarta: Deepublisher)

[34] Mahanani C 2013 Pengembangan Media Pembelajaran Pemahatan Hiasan Busana dengan Teknik Sulam Pita Pada Busana Dalam Bentuk Macromedia Flash di SMK Plus X Magelang. (Magelang: FT UNY)

[35] Choirudin 2017 Efektivitas Pembelajaran Berbasis Schoology. Numerical: Jurnal Matematika dan Pendidikan Matematika 1 52-62

[36] Aminoto T dan Pathoni H 2014. Penerapan Media E-Learning Berbasis Schoology untuk Meningkatkan Aktivitas dan Hasil Belajar Materi Usaha dan Energi di Kelas XI SMA N 10 Kota Jambi. Jurnal Sainmatika. 8 13-29

[37] Salim, Prajono R, Kodirun, Salam M & Rahmat 2018 Penggunaan Learning Management System (LMS) Berbasis Schoology Dalam Pembelajaran Flipped Classroom. Prosiding Seminar Nasional Pendidikan Matematika I Tahun 2018, 274-281

[38] Joshua N, Swastika P A & Estiyanti N M 2015 Efektivitas Penerapan E-learning menggunakan Learning Social Network Schoology di Motivasi & Prestasi Belajar di STMIK. Prosiding Seminar Nasional Pendidikan Teknik Informatika, 96-101, Fakultas Teknik dan Kejuruan Universitas Pendidikan Ganesha, Bali

[39] Kusumantara K S, Santyadiputra G S dan Sugihartini N 2017 Pengaruh E-Learning Terhadap Hasil Belajar Simulasi Digital Dengan Model Pembelajaran SAVI, Jurnal Pendidikan Teknologi dan Kejuruan 14 127-135

[40] Thiagarajan S, Semmel D S dan Semmel M I 1974 Instructional Development for Training Teachers of Exceptional Children. Minnesota: University of Minnesota

[41] Hobri 2010 Metodologi Penelitian Pengembangan (Aplikasi pada Penelitian Pendidikan Matematika) (Jember: Pena Salsabila)

[42] Akbar S 2013 Instrumen Perangkat Pembelajaran (Bandung: Remaja Rosdakarya Offset)

[43] Mardapi D 2016 Pengukuran Penilaian & Evaluasi Pendidikan (Yogyakarta: Nuha Medika)

[44] Chaeruman U A 2013 Merancang Model Pembelajaran Blended Learning Jurnal Teknodik 4 300-409

[45] Joyce B, Weil M & Calhoun E 2004 Models of Teaching (7th ed) (Boston: Pearson Education, Inc.)

[46] Suparno A S 2000 Membangun Kompetensi Belajar (Jakarta: Depdiknas)

[47] Munir 2009 Pembelajaran Jarak Jauh Berbasis Teknologi Informasi dan Komunikasi (Bandung: Alfabeta)

[48] Sutopo H D 2012 Teknologi Informasi dan Komunikasi dalam Pendidikan (Yogyakarta: Graha Ilmu)

[49] Uden L & Beaumont C 2006 Technology and problem-based learning.Hershey (PA: Information Science Publishing)

[50] Manggabarani A F, Sugianti & Masri M 2016 Pengaruh Model Pembelajaran Blended Learning Terhadap Motivasi dan Hasil Belajar Siswa Kelas X SMA Negeri 1 Pitumpanua Kab. Wajo (Studi Pada Materi Pokok Sistem Periodik Unsur). Jurnal Chemicia 17 83–93

[51] Kholifah S N & Budijahjanto I G P A 2016 Pengaruh Model Pembelajaran Blended Learning terhadap Hasil Belajar dan Motivasi Belajar Siswa Kelas XI TEL pada Mata Pelajaran Komunikasi Data dan Interface di SMK Negeri 1 Jetis Mojokerto. Jurnal Pendidikan Teknik Elektro 5 975–982

[52] Sudiarta I G P S, & Sadra I W 2016 Pengaruh Model Blended Learning Berbantuan Video Animasi terhadap Kemampuan Pemecahan Masalah dan Pemahaman Konsep Siswa. Jurnal Pendidikan dan Pengajaran 49 48–58
[53] Imam I, Ayubi A & Bernard M 2018 Pengaruh Pembelajaran Berbasis Masalah terhadap Kemampuan Pemecahan Masalah Matematis Siswa SMA. Jurnal Pembelajaran Matematika Inovatif 1 355–360

[54] Finch C R & Crunkilton 1999 Curriculum Development in Vocational Technical Education Planning, Content, and Implementation. (Sidney: Allyn and Bacon Inc.)

[55] Abei S 2014 Curriculum Model: Product Versus Process. Journal of Education and Practice 5 152-154

[56] Ghirardini B 2011 E-Learning Methodologies: A Guide for Designing and Developing E-Learning Courses. (Rome: Food Agriculture Organization of the United Nations. Inc.)

[57] Yogi M 2016 Blended Learning Experience in Programming Language Course and Effect of the Thinking Styles of the Students on Success and Motivation. TOJET The Turkish Online Journal of Educational Technology 15 32-45

[58] Wong K T, Hamzah MS, Goh P S & Yeop M A 2016 Blended E-Learning Acceptance as Smart Pedagogical Tool: An Initial Study in Malaysia. TOJET The Turkish Online Journal of Educational Technology 15 25-31

[59] Purwaningsih D & Pujianto 2009 Blended Cooperative E-learning (BCEL) sebagai sarana pendidikan penunjang learning community. Disampaikan dalam Seminar Nasional UNY dengan tema “Peranan ICT (Information and Communication Technology) dalam Pembelajaran” pada tanggal 25 Juli 2009 di Ruang Sidang Utama Rektorat UNY

[60] Soekendro H 2020 Blended Learning Bisa Jadi Inovasi Pendidikan Saat Pandemi Corona. accessed August 14, 2020 from https://www.suaramerdeka.com/regional/semarang/237950-blended-learning-bisa-jadi-inovasi-pendidikan

[61] Lewis D E 2002 A Departure from Training by the Book, More Companies Seeing Benefits of E-learning (The Boston Globe: Globe Staff)

[62] Fatmawati K 2020 Blended Learning, Pembelajaran Ideal di Era New Normal. Kompas Accessed July 30, 2020 from ttps://www.kompas.com/edu/read/2020/07/26/blended-learning-pembelajaran-ideal-di-era-new-normal