KWANGSAN

THE EFFECTIVENESS OF THE USE OF E-LEARNING IN MULTIMEDIA CLASSES TO IMPROVE VOCATIONAL STUDENTS' LEARNING ACHIEVEMENT AND MOTIVATION

Efektivitas Penggunaan E-Learning pada Kelas Multimedia untuk Meningkatkan Prestasi dan Motivasi Belajar Siswa SMK

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INFORMASI ARTIKEL	ABSTRACT:
	The development of Information and Communication Technology (ICT) in education has paved the way for the emergence of new teaching and learning methodologies. E-learning, which refers to the use of ICT for learning purposes, is an important area emphasized in education. The purpose of this study was to determine the effectiveness of the use of E-learning in multimedia classes to improve vocational students' learning achievement and motivation. The Quasi-experiment method was used in this study. The research subjects used were class X students at the Veteran Vocational School Sukoharjo, Central Java. This research was conducted in Multimedia classes on computer and basic network subject matter on the topic of sharing devices. Class samples are selected using the random sampling technique. The experiment class consists of 31 students, while the control class consists of 33 students. In this study two formulation of problems were used, namely: (1) How is the effectiveness of E-learning to improve student learning achievement?; (2) How is the effectiveness of E-learning to improve student motivation? The hypothesis test used is the Independent T Test. The results showed that the use of E-learning can significantly improve student achievement and

motivation on computer and basic network subject matter on the topic of sharing devices. In addition, the use of E-learning can also increase student participation in learning.

ABSTRAK:

Perkembangan Teknologi Informasi dan Komunikasi (TIK) dalam pendidikan telah membuka jalan bagi munculnya metodologi pengajaran dan pembelajaran baru. *E-learning*, yang mengacu pada penggunaan TIK untuk tujuan pembelajaran, menjadi area penting yang ditekankan dalam pendidikan. Tujuan dari penelitian ini adalah untuk mengetahui efektifitas penggunaan *E-learning* untuk meningkatkan prestasi dan motivasi belajar siswa di Sekolah kejuruan. Metode kuasi ekperimen digunakan pada penelitian ini. Subjek penelitian yang digunakan yaitu siswa kelas X di SMK Veteran Sukoharjo, Jawa Tengah. Penelitian ini dilakukan di kelas Multimedia pada pelajaran komputer dan jaringan dasar pada topik *sharing devices*. Sampel kelas dipilih menggunakan teknik sampling acak. Kelas eksperimen terdiri dari 31 siswa, sedangkan kelas kontrol terdiri dari 33 siswa. Dalam penelitian ini digunakan dua rumusan masalah, yaitu: (1) Bagaimana keefektifan media *E-learning* untuk meningkatkan prestasi belajar siswa?; (2) Bagaimana keefektifan media *E-learning* untuk meningkatkan motivasi belajar siswa?. Uji hipotesis yang digunakan adalah Uji *Independent T Test*. Hasil dari penelitian ini menunjukkan bahwa penggunaan media *E-learning* secara signifikan dapat meningkatkan prestasi dan motivasi belajar siswa pada mata pelajaran komputer dan jaringan dasar pada topik *sharing devices*. Selain itu, penggunaan *E-learning* juga dapat meningkatkan partisipasi siswa terhadap pembelajaran.

INTRODUCTION

The advancement of information and communication technology (ICT) in recent decades has encouraged the school education sector to integrate ICT into curricula in various subject areas (Kong et al., 2014).

The development of ICT and Internet technology in education has paved the way for the emergence of new teaching and learning

environments and methodologies such as online learning, teleconferencing, web-based distance learning, computer-assisted learning and mixed learning. In recent years, research has revealed that students learn successfully through online learning compared to traditional face-to-face classes (Ho et al., 2016).

The investigation of the use of ICTs as a powerful networking tool has brought a revival in learning. The rapid exchange of information through multimedia throughout the world helps the growth of human knowledge and, at the same time, demands redefinition of education curricula and methods, especially in the field of vocational education (Pevac et al., 2005).

E-learning, which refers to the use of ICT for learning purposes, is an important area emphasized in education. In order to benefit from the E-learning process, students need 21st century skills to support them choosing and processing useful and reliable information from various sources for learning, and to communicate and collaborate with their peers to complete tasks and solve problems (Kong et al., 2014; Shidiq and Yamtinah, 2019).

E-learning is a general term that displays various forms of electronic based learning. E-learning is an important media that can help teachers and students to carry out various online activities. This method is believed to increase the effectiveness and efficiency of learning (Ali et al., 2011).

E-learning is a learning process that is facilitated and supported by the use of information technology and the internet (Warnajith et al., 2012). E-learning is an internet application that can connect between students and teachers in an online study room to overcome the limitations of time, space, conditions, and circumstances (Popovici and Mironov, 2015). E-learning is related to the term online learning. Online learning is part of E-learning, E-learning is a broader concept than online learning, which includes a series of applications and processes that use all electronic media to make training and conventional education more flexible. By using E-learning media in the learning process can improve the students' understanding and practice in the subject matter (Yanuschik et al., 2015).

Efficient E-learning media gives students a learning environment that has a high level of freedom. This allows students to study anytime, anywhere, and whatever they want to learn according to their learning objectives. To realize this, E-learning systems must be equipped with

functions such as letting students choose their own appropriate learning content and understanding the level their progress and achievements for each learning content (Seki et al., 2005).

Learning media, including E-learning, are used by teachers to deliver subject matter not only as a means, but also to provide stimulation for students to learn, as well as develop students' intellectual and emotional aspects. Learning media requires good planning before being used in the learning process. The media used must be fully mastered by the teacher, so that knowledge can be transferred to students clearly and effectively (Tuna et al., 2018).

The use of E-learning as a learning media can help teachers and students to achieve effective and efficient learning goals (Hakim et al., 2019). In addition, the results of the study revealed that the use of e-learning can increase student learning achievement and mastery concept (Hwang et al., 2019; Mustofa, 2019; Wai and Seng, 2014), student interest and motivation (Comarella et al., 2012; Falcinelli et al., 2007; Sebnem, 2015; Sugiarti et al., 2018), attitude (Sebnem, 2015), students' critical thinking skills (Utomo and Wihartanti, 2019), the interaction of students and teachers (Abdelhai et al., 2012), and strategy in overcoming the lectures' numbers (Rivalina, 2017).

Based on a preliminary study of Data from Educational Assessment Center (*Puspendik*) 2017/2018 Academic Year, it was found that the average competence of Vocational Schools in Sukoharjo was 44.46. In addition, observational interest data and learning motivation conducted at one of the vocational schools in Sukoharjo showed that 60% of students had low learning motivation.

Algarable & Dasi (2001) argue that achievement is seen as one's competence in relations with the world of knowledge. This means that if someone has high knowledge, he also has high achievements. While motivation is one of the important aspects in learning. Students with high motivation in learning will be directly proportional to their learning achievement. Conversely, students with low learning motivation tend to have low learning achievements (Algarabel and Dasí, 2001)

Based on the study of E-learning and the problems of the low achievement and learning motivation of vocational school students, this study aims to determine the effectiveness of the use of E-learning in multimedia classes to improve vocational students' learning

achievement and motivation. This research is expected to be a reference source for teachers and education practitioners to use E-learning media to improve students' achievement and motivation.

RESEARCH METHODS

The Quasi-Experiment Method was used in this study. The research subjects were class X students majoring in Multimedia at the Veteran Vocational School Sukoharjo, Central Java. Class samples are selected using the random sampling method. Class X Multimedia 1 as an experiment class consists of 31 students, while class X Multimedia 2 as a control class consists of 33 students.

This research was conducted on Computer and basic networks subjects matter on the topic of sharing devices. The duration of this research was 8 hours of study (8x45 minutes).

Data collection techniques used in this study were questionnaires, observations and tests. A questionnaire was used to determine the level of student learning motivation before and after learning (treatment) conducted. Observation sheet was used to determine the learning conditions in class. The student learning achievement test was used to determine the increase in student learning achievement.

After the data collected is complete, then a statistical analysis is performed with the t-test. The analysis is by testing the significance between experiment class and control class. There are two problem discussed in this study, namely: (1) How is the effectiveness of E-learning media to improve student learning achievement?; (2) How is the effectiveness of E-learning media to improve student learning motivation?

RESULTS AND DISCUSSION
The Effectiveness of E-Learning Media to Improve Student Learning Achievement
The topic of sharing devices under the subject matter of computer and basic networks is one of the topics taught in the Multimedia classes. This research was conducted with the same teacher, the same approach and method, but with different learning media.

The effectiveness of the use of E-learning media can be determined based on the mean differences in learning achievement between the experiment class and the control class. To prove and measure the mean difference in learning achievement, an independent T test is needed.

The scores of the pre-test and post-test of student achievement in each class were analyzed using the SPSS 21 program. The hypothesis test used was the Independent T Test so that the test requirements for normality and homogeneity must be met. Table 1 and Table 2 are summaries of the results of the prerequisite analysis tests.

Table 1. Results of the Normality Test for Learning Achievement

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelompok	Statistic	df	Sig.	Statistic	df	Sig.
Learning Achievement	Pre_control	.179	26	.031	.937	26	.115
	Post_control	.127	26	.200*	.952	26	.252
	Pre_Experiment	.180	25	.035	.929	25	.084
	Post_Experiment	.180	25	.035	.929	25	.084

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table 2. Learning Achievement Homogeneity Test Results

Test of Homogeneity of Variances

Learning Achievement

Levene Statistic	df1	df2	Sig.
.990	1	4	.325

Data normality is based on the significance value of the Shapiro-Wilk Test results, if the Sig. > α (significance level) then the data distribution is normal.

Based on the results of the normality test using the Shapiro-Wilk Test, the pre-test and post-test data for the experiment and control classes respectively were 0.115; 0.252; 0.084; and 0.084. The four significance values produced indicate that Sig. > α (0.050) then the data is normally distributed.

Data homogeneity test uses Levene Test statistics, if the Sig. > α (significance level) then the population data has the same variant (homogeneous).

The results of the homogeneity test obtained a significance value of learning achievement score is 0.325. Based on these data the Sig. > α (0.050), it can be concluded that the variance of the population pre-test and post-test scores of each class is the same or homogeneous.

The comparison test of the mean control and experiment classes used the independent T test. The results are presented in Tables 3 and 4.
The research hypotheses are as follows:

H0: There is no mean difference in the learning achievement between the experiment class and the control class

Ha: There are mean differences in the learning achievement between the experiment class and the control class.

Based on the results of the statistical test in table 3, there is mean difference in learning achievement between the experiment class and the control class. The mean of learning achievement of the experiment class is 77.8, while the control class is 48.19.

Table 3. Descriptive statistics

	Group	Mean	Std. Deviation	Std. Error Mean
Learning Achievement	Experiment	77.84	17.235	3.447
	Control	48.19	17.602	3.452

Table 4. Results of Independent t test

		Levene's Test for Equality of Variances		T-test for Equality of Means		
		F	Sig.	t	df	Sig.(2-tailed)
Learning Achievement	Equal variances assumed	.990	.325	6.075	49	.000
	Equal variances not assumed			6.077	48.982	.000

This result was strengthened by the results of the Independent T Test which showed a Sig. $0.000 < \alpha\ 0.05$. Based on the test, it can be concluded that H0 is rejected and Ha is accepted. Inference from these conclusions is that there are significant mean differences in learning achievement between the experiment class and the control class.

These results prove the effectiveness of E-learning media to improve the learning achievement of vocational students in class X Multimedia. E-Learning platform used in this study is Moodle. The selection of Moodle refers to research by Graf and List (2002) which states that the Moodle Learning Management System (LMS) is better than other LMS (Graf and List, 2005). In addition, many features are provided on LMS Moodle to improve

the quality of learning (Bokor and Hajdu, 2014).

The learning process in the experiment class and control class both uses a scientific approach with a problem-based learning method. Both of these classes are distinguished by the use of instructional media used. The experiment class uses E-learning with the Moodle platform as a learning media, while the control class uses power-point media in the delivery of learning.

There are stages of learning with discussion in the two classes used. The stages of the discussion in the experiment class were carried out online using E-learning media with the prepared Moodle platform. While in the control class the discussion is done directly in class. The results in the experiment class students tend to

be more active in discussions compared to the control class.

The Effectiveness of E-Learning Media to Improve Student Learning Motivation

In addition to improving student learning achievement, E-learning media is also developed to increase student learning motivation. This student learning motivation is measured before and after learning takes place. The results of learning motivation were analyzed using the SPSS 21 program. The hypothesis test used was the Independent T Test, so the test requirements for normality and homogeneity must be met. Table 5 and Table 6 are summaries of the results of the analysis prerequisite tests

Table 5. Results of the Normality of Learning Motivation Test

	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Motivation	pre_control	.145	33	.078	.948	33	.115
	post_control	.155	33	.042	.957	33	.213
	pre_experiment	.117	31	.200*	.959	31	.267
	post_experiment	.128	31	.200*	.937	31	.068

Table 6. Homogeneity Test Results for Learning Motivation

Test of Homogeneity of Variances

Motivation Score

Levene Statistic	df1	df2	Sig.
2.941	1	62	.091

The results of the Shapiro-Wilk test in the table show that the significance values (Sig.) of the four groups are 0.115; 0.213; 0.267; and 0.068 > α (0.050), it can be concluded that the sample (score) originates from the population that is normally distributed.

The data homogeneity test used the Lavene Test statistic. Based on the results of the homogeneity test obtained a significance value (Sig.) Learning motivation score data of 0.091. This means the Sig. > α (0.050) so that it can be concluded that the population variance is the same or homogeneous.

Based on the data of learning motivation above, the prerequisites of the Independent T Test, namely the normality and homogeneity of data, have been fulfilled. The results of the E-learning effectiveness test to improve student learning motivation are presented in Tables 7 and 8.

Table 7. Descriptive statistics

	Group	Mean	Std. Deviation	Std. Error Mean
Learning Motivation	Experiment	81.398	5.237	.940
	Control	75.224	4.719	.821

Table 8. Results of Motivation Independent t test

		Levene's Test for Equality of Variances		T-test for Equality of Means		
		F	Sig.	t	df	Sig.(2-tailed)
Learning Motivation	Equal variances assumed	2.941	.091	4.960	62	.000
	Equal variances not assumed			4.944	60.318	.000

The research hypotheses are as follows:

H0: There is no difference in learning motivation between the experiment class and the control class

Ha: There are differences in learning motivation between the experiment class and the control class.

The results of the analysis with the Independent T Test showed that there was an increase in learning motivation after the E-learning media for vocational students in class X Multimedia. The experiment class has a higher average learning motivation, which is equal to 81.39 compared to the control class which has an average of 75.22. The significance value of learning motivation is Sig. 0,000 < 0.05. This means that there are significant differences in the data on learning motivation between the control group and the experiment group.

Based on the data described, giving different treatments to the control class and experiment class gave different results. E-Learning media with Moodle platform used in the experiment class gives better results in terms of learning achievement and student motivation. Therefore, it can be concluded that E-learning media is effective in improving the learning achievement and motivation of Vocational students in computer and basic networks subjects on the topic of sharing devices.

E-Learning media with Moodle Platform

E-learning systems have been proposed to meet educational goals and to achieve better learning achievement. This system can be divided into two categories according to the level of personal service offered. More specifically, there are systems that completely ignore individual student characteristics, such as motivation, level of

knowledge, goals and learning styles, and provide the same set of resources for all students. On the other hand, some consider these differences and try to adjust educational resources to improve the learning process (Karagiannis and Satratzemi, 2017; Katsigiannakis and Karagiannidis, 2017).

In the first category, Learning Management Systems (LMS) play a dominant role. This method offers a variety of tools to support teachers in creating, managing and managing online courses. WebCT, Blackboard, and Moodle are some of the most popular LMS. Although this system has many advantages, they have one major disadvantage, namely that educational resources are the same for all students (Karagiannis and Satratzemi, 2017).

On the other hand, when trying to provide a tool for personalized learning, researchers have proposed the Adaptive Educational Hypermedia System (AEHS). This system aims to provide students with lessons that suit their individual needs and characteristics. Although adaptive education is a big advantage of the AEHS, this method also has some serious limitations. One example is not having integration, only supporting a number of improved educational functions

through the web (Karagiannis and Satratzemi, 2017).

In this study, E-learning media to improve achievement and student learning motivation used by the type of LMS is Moodle. Moodle (modular object-oriented dynamic learning environment) is a free E-learning software platform, which was originally developed to enable educators to create online courses to encourage interaction and collaborative construction of learning content. This provides several opportunities for teachers to change from being a 'source of knowledge' to being a facilitator and role model in the process of gaining knowledge and skills (Amandu et al., 2013).

The change in the paradigm in 21st century education that is oriented towards the sophistication of ICT in the present requires the existence of innovations carried out in all fields (Coll and Coll, 2018), including education in vocational schools. The innovations made are seen from a variety of new research and application methods, media and approaches to improve the quality of learning.

Research on ICT-based learning that has been carried out in vocational schools includes the development of E-learning media in learning system operations (Tuna et al., 2018), use of

android media-based teaching material (Hakim et al., 2019), use of blended learning (Irawan et al., 2017; Sugiarti et al., 2018) and research on attitudes, views in the use of E-learning in schools (Paechter et al., 2010; Sebnem, 2015; Zhang, 2010).

Not only in vocational schools, the use of E-learning media and blended learning but also widely used in various levels and various subjects to improve student learning achievement. Such as blended learning use in elementary schools (Dey and Bandyopadhyay, 2019; Hwang et al., 2019), Junior high school (Grover et al., 2015; Longo, 2016; Sugiyanta and Sukardjo, 2018; Wang, 2014, 2011), High school (Zain and Jumadi, 2018) and college (Ali et al., 2011; Ho et al., 2016; Wai and Seng, 2014).

In addition, specifically the use of E-learning media with Moodle platform has also been developed by researchers for various purposes. Like the use of Moodle for e-test in blended learning (Dimic et al., 2017), Moodle-based Computer Assisted Assessment (Rutkowski, 2015), Moodle management system (Minovic et al., 2008), and as an E-learning platform (Carmen, 2015; Indzhov et al., 2011; Jordan, 2013; Kukartsev et al., 2018; Quesada et al., 2013; Umek et al., 2015)

Based on a study of the results of research conducted and in line with the study of relevant research results, it can be concluded that the use of E-learning can improve learning experience, motivation, efficiency and student learning achievement (Popovici and Mironov, 2015).

CONCLUSION

The results obtained indicate that E-learning media with Moodle platform can significantly and effectively improve the students' achievement and motivation. In addition, E-learning media with Moodle platform can also increase students' active participation in discussions. The results of this study may be a reference source for teachers and education practitioners in using E-learning in vocational schools.

REFERENCES

Abdelhai, R., Yassin, S., Ahmad, M.F., Fors, U.G., 2012. An e-learning reproductive health module to support improved student learning and interaction: a prospective interventional study at a medical school in Egypt. BMC Med. Educ. 12, 11.

Algarabel, S., Dasí, C., 2001. The definition of achievement and the construction of tests for its measurement: A review of the main trends. Psicológica 22, 43–

66.

Ali, Z.M., Mustafa, Z., Ying, Y.S., Suradi, N.R.M., Abidin, N.Z., Shahabuddin, F.A., Embi, M.A., Ahmad, S., 2011. E-Learning service in the School of Mathematical Sciences. Procedia - Soc. Behav. Sci. 18, 316–325.

Amandu, G.M., Muliira, J.K., Fronda, D.C., 2013. Using moodle e-learning platform to foster student self-directed learning : Experiences with utilization of the software in undergraduate nursing courses in a Middle Eastern university. Procedia - Soc. Behav. Sci. 93, 677–683.

Bokor, O., Hajdu, M., 2014. The use of eLearning in teaching construction management core subjects. Procedia Eng. 85, 75–83.

Carmen, G., 2015. A Study about Using E-learning Platform (Moodle) in University Teaching Process. Procedia - Soc. Behav. Sci. 180, 426–432.

Coll, S.D., Coll, R.K., 2018. Using blended learning and out-of-school visits: pedagogies for effective science teaching in the twenty-first century. Res. Sci. Technol. Educ. 36, 185–204.

Comarella, R.L., Silveira, R.A., Campos, R.L.R., Catapan, A.H., 2012. e-Learning course educational Linux for high school students in Brazil. Proc. 12th IEEE Int. Conf. Adv. Learn. Technol. ICALT 2012 268–269.

Dey, P., Bandyopadhyay, S., 2019. Blended learning to improve quality of primary education among underprivileged school children in India. Educ. Inf. Technol. 24, 1995–2016.

Dimic, G., Predic, B., Rancic, D., Petrovic, V., Macek, N., Spalevic, P., 2017. Association analysis of moodle e-tests in blended learning educational environment. Comput. Appl. Eng. Educ.

Falcinelli, E., Falcinelli, F., Laici, C., Milani, A., 2007. Experience of blended e-learning in post-graduate training for High School Teaching Qualification. Proc. - Int. Work. Database Expert Syst. Appl. DEXA 06123, 663–667.

Graf, S., List, B., 2005. An Evaluation of Open Source E-Learning Platforms Stressing Adaptation Issues *. Proc. Fifth IEEE Int. Conf. Adv. Learn. Technol. 5–7.

Grover, S., Pea, R., Cooper, S., 2015. Designing for deeper learning in a blended computer science course for middle school students. Comput. Sci. Educ. 25, 199–237.

Hakim, S.R., Kustijono, R., Wiwin, E., 2019. The use of android-based teaching materials in physics learning process at vocational high school. J. Phys. Conf. Ser. 1171.

Ho, V.T., Nakamori, Y., Ho, T.B., Lim, C.P., 2016. Blended learning model on hands-on approach for in-service secondary school teachers: Combination of E-learning and face-to-face

discussion. Educ. Inf. Technol. 21, 185–208.

Hwang, R.-H., Lin, H.-T., Sun, J.C.-Y., Wu, J.-J., 2019. Improving Learning Achievement in Science Education for Elementary School Students via Blended Learning. Int. J. Online Pedagog. Course Des. 9, 44–62.

Indzhov, H., Totkov, G., Doneva, R., 2011. (E-Learning in a Moodle-based Adaptive and Accumulative System). IEEE Int. Conf. Comput. Syst. Technol. 2, 498–503.

Irawan, V.T., Sutadji, E., Widiyanti, 2017. Blended learning based on schoology: Effort of improvement learning outcome and practicum chance in vocational high school. Cogent Educ. 4, 1–10.

Jordan, C., 2013. Comparison of International Baccalaureate (IB) chemistry students' preferred vs actual experience with a constructivist style of learning in a Moodle e-learning environment. Int. J. Lesson Learn. Stud.

Karagiannis, I., Satratzemi, M., 2017. Enhancing Adaptivity in Moodle : Framework and Evaluation Study.

Katsigiannakis, E., Karagiannidis, C., 2017. Gamification and Game Mechanics-Based e-Learning : A Moodle Implementation and Its Effect on User Engagement. In: Research on E-Learning and ICT in Education. 10.1007/978-3-319-34127-9_11, pp. 147–159.

Kong, S.C., Chan, T.-W., Huang, R., Cheah, H.M., 2014. A review of e-Learning policy in school education in Singapore, Hong Kong, Taiwan, and Beijing: implications to future policy planning. J. Comput. Educ. 1, 187–212.

Kukartsev, V., Chzhan, E., Tynchenko, V., Antamoshkin, O., Stupina, A., 2018. Development of Adaptive E-Learning Course in Moodle System. SHS Web Conf. 50.

Longo, C.M., 2016. Changing the instructional model: Utilizing blended learning as a tool of inquiry instruction in middle school science. Middle Sch. J. 47, 33–40.

Minovic, M., Štavljanin, V., Milovanovi, M., Star, D., 2008. Usability Issues of e-Learning Systems : Case-Study for Moodle Learning Management System.

Mustofa, Z., 2019. Pengaruh Discovery Learning Berbantuan E-Learning dalam Meningkatkan Penguasaan Konsep Siswa Tentang Konsentrasi Larutan dan Aplikasinya. Kwangsan: Jurnal Teknologi Pendidikan, 7(1), 14. DOI: https://doi.org/10.31800/jtp.kw.v7n1.p14--29

Paechter, M., Maier, B., Macher, D., 2010. Students' expectations of, and experiences in e-learning: Their relation to learning achievements and course satisfaction. Comput. Educ. 54,

222–229.

Pevac, D.V., Milanovic, K.S., Milosavljevic, M.M., 2005. E-learning Method Implementation in the High School Vocational Education. IEEE EUROCON 2005 - Int. Conf. "Computer as a Tool" 835–838.

Popovici, A., Mironov, C., 2015. Students' Perception on Using eLearning Technologies. Procedia - Soc. Behav. Sci. 180, 1514–1519.

Quesada, J., Calvo, I., Sancho, J., Sainz, A., Sánchez, J., Gil-garcía, J.M., Sebastián, R., Castro, M., 2013. Combining Moodle and Redmine as e-learning tools in Project Based Learning of Industrial Electronics. 7th IEEE Int. Conf. e-Learning Ind. Electron. 86–91.

Rivalina, R., 2017. Strategi Pemanfaatan E-Learning dalam Mengatasi Keterbatasan Jumlah Dosen. Kwangsan: Jurnal Teknologi Pendidikan, 5(2), 129. DOI: https://doi.org/10.31800/jtp.kw.v5n2.p129--145

Rutkowski, J., 2015. Moodle-Based Computer-Assisted Assessment in Flipped Classroom. In: Smart Education and Smart E-Learning, Smart Innovation, Systems and Technologies. Gliwice, pp. 37–46.

Sebnem, K.I., 2015. Investigation of students attitudes towards e-learning in terms of different variablesA case study in a technical and vocational high school for girls. Educ. Res. Rev.

10, 81–91.

Seki, K., Tsukahara, W., Okamoto, T., 2005. System development and practice of e-Learning in graduate school. Proc. - 5th IEEE Int. Conf. Adv. Learn. Technol. ICALT 2005 2005, 740–744.

Shidiq, A.S., Yamtinah, S., 2019. Pre-service chemistry teachers' attitudes and attributes toward the twenty-first century skills. In: Journal of Physics: Conference Series.

Sugiarti, Y., Nurmayani, S., Mujdalipah, S., 2018. Analysis of Blended Learning Implementation on Waste Treatment Subjects in Agricultural Vocational School. IOP Conf. Ser. Mater. Sci. Eng. 306.

Sugiyanta, L., Sukardjo, M., 2018. Adjusted Framework of M-Learning in Blended Learning System for Mathematics Study Field of Junior High School Level VII. IOP Conf. Ser. Mater. Sci. Eng. 336.

Tuna, J.R., Manoppo, C.T.M., Kaparang, D.R., Mewengkang, A., 2018. E-Learning Development Process for for Operating System Course in Vocational School. IOP Conf. Ser. Mater. Sci. Eng. 306.

Umek, L., Aristovnik, A., Tomaževič, N., Keržič, D., 2015. Analysis of Selected Aspects of Students ' Performance and Satisfaction in a Moodle-Based E-Learning System Environment. Eurasia J.

Math. Sci. Technol. Educ. 11, 1495–1505.

Utomo, S.W., Wihartanti, L.V., 2019. Penerapan Strategi Blended Learning untuk Meningkatkan Kemampuan Berpikir Kritis Mahasiswa pada Era Revolusi Industri 4.0. Kwangsan: Jurnal Teknologi Pendidikan, 7(1), 30. DOI: https://doi.org/10.31800/jtp.kw.v7n1.p30--44.

Wai, C.C., Seng, E.L.K., 2014. Exploring the Effectiveness and Efficiency of Blended Learning Tools in a School of Business. Procedia - Soc. Behav. Sci. 123, 470–476.

Wang, T., 2014. Developing an assessment-centered e-Learning system for improving student learning effectiveness. Comput. Educ. 73, 189–203.

Wang, T.H., 2011. Developing Web-based assessment strategies for facilitating junior high school students to perform self-regulated learning in an e-Learning environment. Comput. Educ. 57, 1801–1812.

Warnajith, N., Dassanayake, G., Dahanayaka, D.D.G.L., Tonooka, H., Minato, A., Ozawa, S., Perera, M.P.M., 2012. Prototype of E-Learning Management System for secondary school in Sri Lanka. 2012 Int. Conf. Inf. Technol. Based High. Educ. Training, ITHET 2012.

Yanuschik, O. V., Pakhomova, E.G., Batbold, K., 2015. E-learning as a Way to Improve the Quality of Educational for International Students. Procedia - Soc. Behav. Sci. 215, 147–155.

Zain, A.R., Jumadi, 2018. Effectiveness of guided inquiry based on blended learning in physics instruction to improve critical thinking skills of the senior high school student. J. Phys. Conf. Ser. 1097.

Zhang, L., 2010. A feasibility study on the adoption of e-learning for middle school teachers' continuing education in China. Proc. - 2011 8th Int. Conf. Inf. Technol. New Gener. ITNG 2011 1052–1053.