Jurnal Inovasi Pendidikan Fisika *Vol. 07 No. 02, Juli 2018, 159-164*
ISSN: 2302-4496

IMPLEMENTING BLENDED LEARNING IN THERMODYNAMICS MATERIALS TO GRADE XI SENIOR HIGH SCHOOL 16 SURABAYA

Fatichatul Nurillah L., Titin Sunarti
Physics Department, Faculty of Mathematics and Natural Science, State University of Surabaya
Email: fatichatullailaturidloh@mhs.unesa.ac.id

Abstract

Blended Learning (BL) is popular and innovative learning in 21st Century and it is believed to decrease the portion of face-to-face instruction in Inquiry and Problem Based Learning (PBL). BL is learning activity that integrate several learning approaches, learning models and learning media. This research aimed to describe the implementation of Blended Learning in Thermodynamics materials to grade XI Senior High School 16 Surabaya. The type of this research is descrptive quantitative. The sample are XI-MIA 1 and XI MIA-2 and it is determained by using random sampling technique. The implementation of Blended Learning is observed by two observers using instructional learning sheet. The score is calculated from the average score of two observers in each class. The implementation of the online class is describe the students activity in Quipper School. The results of the implementation of first meeting with Cooperative learning using JIGSAW is 94% in the class experiment 1 and 93% in the class experiment 2. The second meeting with Inquiry using BL method is 93% for each class. The third meeting with Problem Based Learning using BL method is 90% in the class experiment 1 and 91% in the class experiment 2. The student activity in the online classroom using Quipper School is implemented well and it reinforce for this instruction.
Keywords: Implementing Blended Learning, Quipper School.

PRELIMINARY

The implementation of Curriculum 2013 is oriented by the scientific approach that have scientist stages : observe, ask a question or identify a problem, search for existing solutions, formulate hypothesis, design and do experient to test the hypothesis, analyze data and make a conclusion and report the results. Those stages are able to train individuals to have 21th Century skills. Based on the Regulation of Education and Culture Ministry Number 65 year 2013 about process standards, learning models that are suggested to implement the Curriculum 2013 are Inquiry Based Learning, Problem Based Learning (PBL) and Project Based Learning (Sufairoh, 2016). The implementation of those models is expected to resolve the challenge in education. The internal challenge is creating human resources in productive age to have competence and skills. The external challange is the participation of Indonesian pupil in international test such as Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assesment (PISA). Implementing Inquiry will make learners try to understand nature as a science application and provide explanations to what he observes (Rakhmawan, et al., 2015). While implementing Problem Based Learning trains the learners to have meaningful knowledge, the ability and the attitude that required in professional life (Moraes & Castellar, 2010). Sanjaya (2013) mentioned that one of the weaknesses in both Inqury and PBL are require more times and resources. According to Lukman (2015) the solution to diminishing the lack of time and learning resources in both Inquiry and PBL is implementing Blended Learning.

Blended Learning generally known as (i) integrated traditional learning with web-based learning, (ii) combining learning media and learning tools such, (iii) integrating online and face-toface learning to resolve the lack of time during instruction (Graham, 2003). Blended Learning is combining the best traits of online instruction with the best traits of face-to-face instruction to increasing independent and active learning of the learners and decreasing face-to-face learning (Husamah, 2014). Based on the research by (Suana, *et al.*, 2017), Blended Learning stages can be designed as the Figure. 1 below :

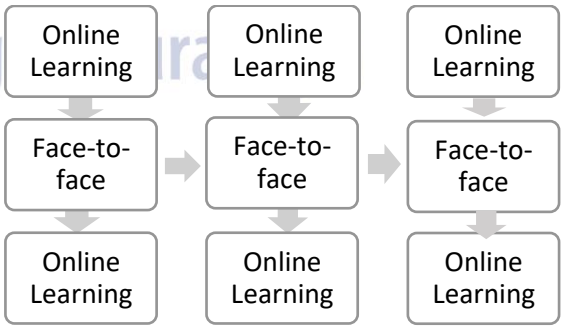


Figure 1. Blended Learning Stage Used in this Research

From the Figure 1 researcher design the online learning and face-to-face learning for every sub material in Thermodynamics. From the Figure.1 the

stage of Inquiry with blended method could be parted, the parted stages show in the Figure 2 below:

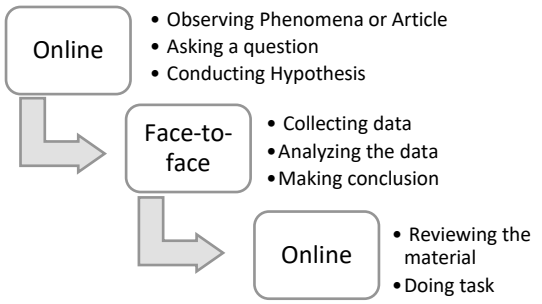


Figure 2. Inquiry Stages with Blended Method

While the stage of Problem-based with Blended Learning method show in the Figure 3 below :

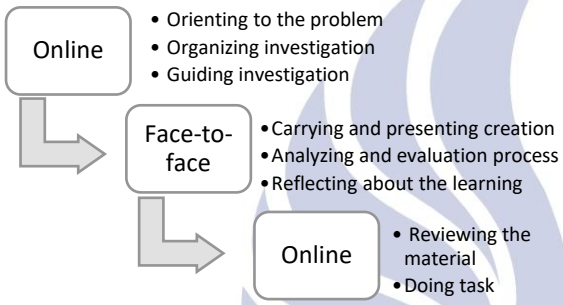


Figure 3. Problem-based Stages with Blended Method

This parted stage was inspirationed by Rahmadani (2017) that developed learning instruction plan (RPP) for the Global Warming materials.

Pre-experiment was held on the same population at Senior High School 16 Surabaya. The sample was 29 students from XII-MIA 7 class that finished study Thermodynamics materials show that 74% of learners prever to learn Thermodynamics materials using combined instructional (face-to-face and online classroom), 13% of learners prever to conventional learning and 13% more is prever to online learning. Thermodynamics materials is widely applied either in phenomena and technology, such us the thermodynamis system in the body, the steam locomotive, the mechine on motor, refrigenerator and air conditioner. To be able to understand this material, the learner is requires the ability of scientific literacy to understand, investigate and evaluate the concept and its technology application in the real life. In addition, the result from student's questionnaire during pre-experiment shows that learners are interesting to learn Thermodynamics materials and its application both in the real life and technology.

Previous research by Wijayanti (2017) developing learning instruction with Blended Learning could improved technology information skills, communication skills and it could be the solution for teacher who lack of time in delivering dynamic electricity materials. Blended Learning has been applied by Adi (2017) by integrating it with Guided Inquiry and Structured Inquiry, from this research it was proved that GI-BL and SI-BL could trained the critical thinking ability, communication literacy and scientific literacy. Based on the description above, the researcher have an initiative to implementing Blended Learning in Thermodynamics materials to grade XI at Senior High School 16 Surabaya.

METHOD

This research is using pre-experiment method with descriptive quantitative analysis. The sample in this research is obtained by random sampling technique with 38 students from XI MIA-1 Class as Experiment 1 (E1) and 38 students from XI MIA-2 Class as Experiment 2 (E2). This research was obtained in April on academic year 2017-2018.

The research tools are syllabus, RPP, LKPD, and The student's book of Thermodynamics materials. Those learning tools were validated by two validator. The validator is two lectures from Physics Department in the State University of Surabaya. The results is obtained by calculating the percentage of the average from both validators to conclude the validity and calculating the Cohen's Kappa coeficient for reliability. The results of validity and reliability obtained that learning tools in this research was valid and reliable to used.

The instrument in this research is the observation sheet of the implementation of Blended Learning. The observation sheet was designed based on syntax from learning instruction plan (RPP). The persentage of the score in learning activity was obtained from :

$$\text{Average Score (\%)} = \frac{The\ total\ of\ scores\ gained}{The\ \max\ value\ of\ the\ score}\ x\ 100\%$$

(Riduwan, 2010)

With the implementation category :
0% - 20% = Very rough
21% - 40% = Rough
41% - 60% = Enough
61% - 80% = Great
81% - 100% = Very great

Each syntax is implementing well if the persentage of the average score from both observers is $\geq$ 61%.

RESULT AND DISCUSSION

Result

Table 1 demonstrate the score of the implementation in the first meeting with cooperative model using type JIGSAW. The observed aspect was taken from learning instruction plan (RPP).

Table 1. Implementation of the First Meeting

Observed Aspect		Persentage Score		
		E1	E2	A
Preliminary	Greeted & Prayed together	100%	100%	98%
	Motivated the learners	100%	100%	
	Checked the initial knowledge about the materials	100%	100%	
	Gived appreciation and feedback	90%	90%	
Phase 1 : Passing goals and preparing the learners	Gived video motivation	90%	90%	90%
	Gived the opportunity to the learners for comunicate the observation from the video	90%	90%	
	Explained the learning goals	90%	90%	
Phase 2 : Passing information about learning instruction	Explained for the learning activity	90%	90%	95%
	Shared the book of Thermodynamics materials for the learners	100%	100%	
Phase 3 : Set learners into the group	Formed a group and conditioned the class	90%	80%	90%
	Shared the LKPD-1 (Thermodynamics processes)	90%	90%	
	Explained the rules of JIGSAW	90%	90%	
Fase 4 : Setting up group to learn	Observed the learner interaction	100%	100%	97%
	Performed assessment	90%	90%	
	Briefed the group	100%	100%	
Closing	Reflected the learning process	90%	90%	97%
	Gived information about the next meeting	100%	90%	
	Closed and said greetings	100%	100%	

Description : E1 =Experiment 1 (XI-MIA 1), E2 =Experiment 2 (XI-MIA 2), A= average of each learning phase

From Table 1 it is concluded that learning implementation for each phase at the first meeting is very great. There was a problem of the allocation time in phase 3 "set the learners into the group" which is class Experiment 2 get the average score 80%. This problem could be solved by asking for teachers opinion who knew the characteristics of learners in each class to formed group, so those groups were accepted well by the learners.

Table 2 below demonstrate the results of the implementation of learning in the second meeting with Inquiry model using Blended Learning method. In the online class meeting, the theacher was prepared the evaluation and summary in addition for the first meeting. This online meeting was used Quipper School App for the learning process and used Line chatroom for discussing the materials.

Tabele 2. Implementation of the Second Meeting

Observed Aspect		Percentage Score		
		E1	E2	A
Online class				
Phase 1 : Presenting Phenomena	Shared summary and evaluation about previously meeting	80%	90%	87%
	Shared an article/ phenomena about "First Law of Thermodynamics in the Human Body". It is the same phenomenon with the phenomenon in LKPD-2 (First Law of Thermodynamics)	90%	90%	
Phase 2 : Determining the problem and making hypothesis	Discussed to determine scientific question from the phenomena.	80%	80%	
	Conducted the hypothesis	90%	90%	
Fase 3 : Designing the experiment	Shared LKPD-2 (The first Law of Thermodynamics)	90%	90%	
	Comanded the leearners to downloaded LKPD-2 and discussed it with the group.	90%	90%	
Face-to-face class				
Preliminary	Greeted and prayed together	100%	100%	93%
	Motivated the learners	80%	80%	
	Checked the initial knowledge of the learners about the topic	100%	100%	
	Gived appreciation and feedback for the learner who give their opinion about the topic	90%	90%	
Fase 1 : Presenting Phenomena	Presented the same phenomena that was held in online classroom	80%	80%	90%
	Delivered the purpose of the learning	100%	90%	
Fase 2 & 3 : Conducted in the online classroom	Informed the learners to review LKPD-2 (The First Law of Thermodynamics) and chekded the procedure of the experiment that have conducted by the learners.	90%	90%	90%
Fase 4 : Implemen-ting the experiment	Gived opportunity to the learners for implementing the experiment using PhET Simulation	100%	100%	100%
	Monitored the collaboration of each group	100%	100%	
Fase 5 : Analyzing data and conducting the conclution	Observed the learner discussion	100%	100%	90%
	Provided the opportunity to one group for presented their data.	90%	90%	
	Guided the learners to conducted the conclusion	80%	80%	
Fase 6 : Evaluation and Discussion	Presented the diagram of thermodynamic cycle in the body	100%	100%	100%
	Discussed about the sub materials of thermodynamic cycle	100%	100%	

Observed Aspect		Percentage Score		
		E1	E2	A
Closing	Reflected the learning process	80%	80%	93%
	Gived the information about the next meeting and anticipated the student to checking online class in Quipper School	100%	100%	
	Closed the learning and greeted	100%	100%	

Description : E1 =Experiment 1 (XI-MIA 1), E2 =Experiment 2 (XI-MIA 2), A= average of each learning phase

From Table 2 it is concluded that learning implementation for each phase at the second meeting is between great and very great. The problems in the second meeting are (i) during online discussions on line group to determined scientific questions and unscientific question, the response given by the learner is not as planned, (ii) during online discussions researcher was forgotten to instructing the learner for carry the laptop. The solution to resolve this problems is before carrying the lesson, it is necessary to held a briefing about what kind of scientific question and unscientific question and prepered additional laptops as a learning facility.

Table 3 shows the results of the third meeting with problem-based learning model (PBL) using the Blended Learning method.

Tabel 3. Implementation of the Third Meeting

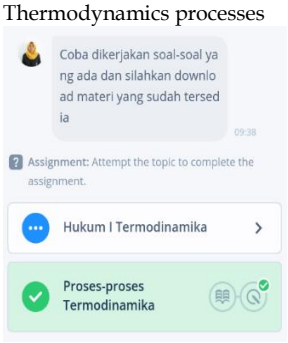
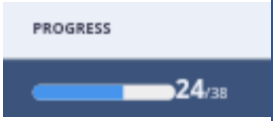
Observed Aspect		Percentage Score		
		E1	E2	A
Dalam Kelas *Online*				
Phase 1 : Orienting the learners tothe problem	Shared an article about "The Simple Stirling Mechine"	90%	90%	88%
	Shared LKPD-3 that have same problem with the articles	80%	90%	
Phase 2 : Organizing investigation	Divide the class into several team work programs	90%	90%	
Fase 3 : Membimbing penyelidikan mandiri dan kelompok	Shared a video about the simple stirling mechine	90%	100%	
	Asked for each team work for collaborate with the team	80%	100%	
Face-to-face class				
Preliminary	Greeted and prayed together	90%	100%	88%
	Motivated the learners	90%	90%	
	Checked the initial knowledge of the learner	100%	80%	
	Gived the appreciation and feedback	80%	80%	
Phase 1 : Orienting to the problem	Informed the learner to the problem in LKPD-3	90%	100%	95%
	Delivered about learning goals	90%	90%	
Phase 2 : Organizing investigation independent-ly or in group	Asked the learners to get together with each team work program	90%	100%	95%
Phase 3 : Guiding investigation independent-ly or in group	Gived chance for every team work program to complete their task	100%	90%	
	Observed the discussions	100%	100%	
Phase 4 : Carriying and presenting the creation	Gived the opportunity for the the learners to presented the creation	90%	90%	95%
	Memonitored the activity along discussions	100%	100%	
Phase 5 : Analyzing andd evaluating process	Provided learners for asking a question	80%	80%	83%
	Gived feedback	80%	90%	
	Evaluated about the activity	90%	80%	
Closing	Reflected about the learning	80%	90%	90%
	Giving the information about the next meeting	90%	90%	
	Closed the learning and greeted	90%	90%	

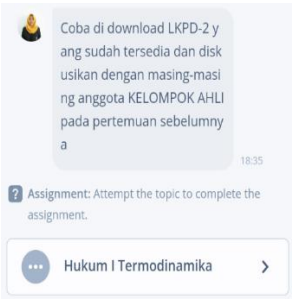
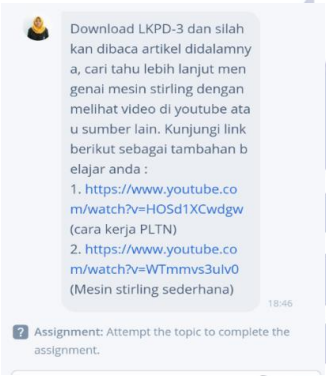
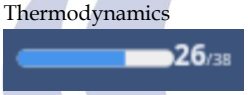
Description : E1 =Experiment 1 (XI-MIA 1), E2 =Experiment 2 (XI-MIA 2), A= average of each learning phase

From Table 3 it is concluded that learning implementation for each phase at the third meeting in both classes is between great and very great. The problems in the third meeting is difficult to implementing problem-based learning with Thermodynamics materials because it required a deep knowledge to understand about the concept and skill to making the simple stirling mechine. In addition, it needed many tools and materials that would be incriminating the learners.

Table 4 revealed the activity of learners in online classroom using Quipper School App.

Table 4 Students' Activity in Quipper School

Activity	Implementation
The learnerjoin to the online class at Quipper School	All the learners have joined the online class 
The learners reviewed the meeting then did the task about Thermodynamics processes 	About 24 learners from XI-MIA 1 class did these task about Thermodynamics processes and 24 learners from XI-MIA 2 either. 

Activity	Implementation
The learner downloaded LKPD-2 about "The First Law of Thermodynamics" and also did the review about the second meeting then did the task about this materials 	About 27 learners from XI-MIA 1 class did these task about The First Law of Thermodynamics and 27 learners from XI-MIA 2 either. 
The learner downloaded LKPD-3 about "The Simple Stirling Mechine" and also did the review about the third meeting then they did the task about this materials 	About 24 learners from XI-MIA 1 class did these task about Second Law of Thermodynamics  while 25 learners from XI-MIA 2 class. 

Descrption : E1 =Experiment class 1 (XI-MIA 1), E2 =Experiment class 2 (XI-MIA 2)

Discussion

Blended Learning (*BL*) is a combination from various learning approaches, learning models and learning media that intergated it into face-to-face learning and online learning (Graham, 2003). Blended Learning is a solution for teacher who lack their time in applying Inquiry learning (Wijayanti, 2017). In this research , Blended Learning was applied by complining the learning instruction plan (RPP) on the Thermodynamics materials using JIGSAW for the first meeting, Inquiry learning with Blended Learning Method and Problem-base Learning with Blended Learning Method.

Learning Theories that support Blended Learning according to (Rasmussen & Davidson-Shivers, 2006) are (i) behaviorism theory, this theory can be seen on the repeated stage in learning instruction, in additional the learners could repeated the excercises and materials from online class after the face-to-face instruction, (ii) Theory of Cognitive and Constructivism theory, this theory is shown at the Inquiry and Problem-based Learning where the learners are able to construct their knowledge independently and teacher as facilitator preparing LKPD (Student Work Sheet) based scientific literacy.

The implementation of learning in online class can be observed using Quipper School as a Learning Management Program (LMS). Based on the Table 4 noted that not all of learners did their task in each material. Based on the research by using questionnaire to this implementation of Blended Learning, the reason that the learners did not doing their task is because of difficulity to access internet connection and there is no time because there are many task from the other subject.

CONCLUSION

Based on this research, the result can be cocluded by calculating the average score for each meeting and the result shows that implementing Blended Learning is very great in both of experiment classes with score in every meeting $\geq$ 81%.

SUGGESTION

Based on the implementing Blended Learning in Thermodynamics materials that have done by the researcer, there are some suggestions for the next research :

1. Using LMS that commonly used by learners.
2. Checking back the materials that avilable in the Quipper School.
3. Discussing with theteacherswho already know the characteristics of each class to form heterogen group or team .
4. Provide additional facilities such us laptop and cable for using PhET Simulation for learning.
5. Checking back the initial ability of learners, tools and materials used in learning process.

REFERENCES

Graham, C. R. (2003). *Handbook of blanded learning: Global Prespectives.* San Fransisco: Pfeiffer Publishing.

Husamah. (2014). *Pembelajaran Bauran (Blended Learning)*. Jakarta: Prestasi Pustaka.

Kemendikbud. (2016). *Permendikbud Nomor 22 Tahun 2016 Tentang Standar Proses Pendidikan Dan Menengah.* Jakarta: Kemendikbud.

Moraes, J. V., & Castellar, S. M. (2010). Scientific Literacy, Problem Based Learning and Citizenship : A sussgestion for Geography Studies Teaching. *Problems of Education in the 21th Century*, 119-127.

Rasmussen, K. L., & Davidson-Shivers. (2006). *WEb Base Learning Design, Implementation and Evaluation.* New Jersey: Pearson.

Riduwan. (2010). *Skala Pengukuran Variabel-variabel Penelitian.* Bandung: Alfabeta.

Suana, W., Maharta, N., Nyeneng, I., & Wahyuni, S. (2017). Design and Implementation of Schoology-Based Blended Learning Media for Basic Physics I Course. *JPII*, 170-178.

Sufairoh. (2016). Pendekatan Saintifik & Model Pembelajaran K-13. *Jurnal Pendidikan Profesional*, 116-125.

Wijayanti, W. (2017). Pengembangan Perangkat Blended Learning Berbasis Learning Management System pada Materi Listrik Dinamis. *Jurnal Ilmiah Pendidikan Fisika Al-BiRuNi*, 1-12.