Does the hybrid learning model affect student outcomes in thermochemistry?

Rusman, N Amali and R F I Rahmayani
Department of Chemistry Education, Universitas Syiah Kuala, Banda Aceh 23111, Indonesia
Email: amalinurul13@gmail.com

Abstract. The technology that develops has an impact on education causes changes in learning styles; learning can be done anywhere at anytime. This fact is one of the reasons that a learning model to integrate conventional learning and online learning is needed. This research aims to determine the effect of the application of the hybrid learning model on student learning outcomes in thermochemistry in the Basic Chemistry subject of the 2018/2019 academic year. The approach used in this study is a quantitative method using the quasi-experiment research type. The technique of data collection used was in the form of tests and the observation forms. Hypothesis test was using the t-test. Hypothesis results that Ha is accepted because the value of \( t_{\text{count}} > t_{\text{table}} \) is 2.130 > 2.036. Based on the results, it can be concluded that there is an influence of the hybrid learning model to the student outcomes in learning thermochemistry.

1. Introduction

Government Regulation No. 74 in 2008 stipulates that a teacher must master in the fields of science, technology, art, and culture. The concept and mechanism for information technology-based teaching and learning (IT) becomes as unavoidable in the world of education as the development of technology information [1]. The progress of technology information has resulted in the development of various learning media today. The internet is the beginning to make the learning process easier to access. This paradigm changes the education system in the 21st century. Learning can be done anytime and anywhere. This internet-based learning is better known as e-learning [2].

E-learning is an innovation in the learning process, learning in this way not only increases the mastery of learning material but also changes in the abilities of various competencies of students. Through e-learning, students not only listen to material descriptions from the teacher but also actively observe, do, and demonstrate. Teaching material can be virtualized in various formats to make it more interesting and more dynamic so that it can motivate students in the learning process. E-learning is more effective and efficient compared to traditional learning [2].

Universitas Syiah Kuala has provided e-learning applications, but not many lecturers utilized the facility. The learning combined between conventional learning and e-learning can be used as an alternative to achieve the demands of the regulation of the Ministry of Research, Technology and Higher Education of Indonesia No. 44 of 2015. In addition to a face-to-face meeting, lecturers must also provide structured assignments to students. According to the regulation, 1 credit in the learning process in the form of lecturers, responses or tutorial consists of 50 minutes face-to-face, 60 minutes structured assignments, and 60 minutes of independent activities per week per semester.

E-learning not only is used for structured activities, but also in person. This might happen if using the hybrid learning model, the application of online learning models can be done with full online
learning (without a face-to-face meeting between teachers and students) or blended learning/hybrid learning (sometimes is done online) [2]. Hybrid Learning is a learning model that integrates innovation and technological progress through an online learning system with the interaction and participation of traditional learning models. This learning model will integrate instructional methods face-to-face with the learning process online [3].

The research that has been done using the hybrid learning model using e-learning media is those who implemented a hybrid learning model in the learning process of statistics II in the FPEB UPI management study program [3]. Another research also deals with the use of a hybrid learning model with e-learning media to improve the cognitive abilities of middle school students [4]. There have been no studies with hybrid learning models on chemistry teaching material focusing on thermochemistry. Thermochemistry is uses many abstract concepts and has a direct implementation in everyday life. Thermochemistry was studied by all second-semester chemistry students who took basic chemistry course in college.

2. Method
This research is the quasi-experiment type, with a quantitative approach. The design used in this quasi-experiment research is the design of the non-equivalent control group. The subject of research will be taken at the same group/level but does not need to be the same person. The group divided into 2 groups, the experimental group using face-to-face learning and the control group using hybrid learning. The table for non-equivalent group design[4]. The design can be seen in Table 1. In this following:

| Group       | Pre-test | Treatment | Post-test |
|-------------|----------|-----------|-----------|
| Experimental class | $O_1$   | $X_1$     | $I_1$     |
| Control class   | $O_2$   | $X_2$     | $I_2$     |

Keterangan :
- $O_1$: pre-test for experimental class
- $X_1$: face-to-face learning implementation
- $O_2$: pre-test for control class
- $I_1$: post-test for experimental class
- $X_2$: face-to-face learning implementation
- $I_2$: post-test for control class

The student who took basic chemistry course has been grouped into two classes; 01 and 02. The treatment was given in experimental class (01), while class 02 became the control class. The data in this study was carried out by giving tests, giving questionnaires, and observing. Written test questions to see student learning outcomes and questionnaires to see student activities and responses. The feasibility test of the instrument is completed by testing the validity and reliability test. The impact of the hybrid learning model implementation is known by testing the hypothesis. Before the hypothesis test, it is necessary to do an analysis prerequisite test in the form of a normality test to see the data distribution and homogeneity test to ensure both sample variants are homogeneous, the formulated hypothesis will be tested with parametric statistics that data of each variable analyzed must be normal homogenous [5].

3. Results
The results of this study include the results of the instrument feasibility test, the results of hypothesis testing, analysis of the impact of the hybrid learning model implementation in learning outcomes, student activities, and responses.

3.1 Instrument feasibility test
The instrument used was 20 multiple choice questions in determining the outcomes of students. The pre-test and post-test questions used were the same. The implementation of the test on the control class was done manually, that is by giving the package system A and B by randomizing the question number.
Tests for the experimental class was conducted online and the questions’ order and options were randomized by the e-learning platform.

3.1.1 Instrument validity. Qualitative test of the validity was done by providing a validation sheet to two chemistry education lecturers who teach basic chemistry to validate the questions given to students. Based on the results of the calculation, the percentage value of the validation obtained qualitatively is equal to 98.5% so, the instrument used is valid and also feasible. Quantitatively, question validation is done through calculations using Microsoft Excel. There are 20 multiple-choice questions which in each correct answer get a value of 1 and the wrong answer gets a value of 0. Quantitative validation testing was carried out by looking for a correlation. The correlation formula stated by Pearson is known as the product-moment correlation formula. By obtaining an index of the validity of each item can be known with certainty which items do not meet the requirements in terms of validation. Based on the results of calculations, 16 questions were declared valid and 4 invalid questions.

3.1.2 Instrument reliability. Based on the calculation of the reliability value, the value of $\rho_{11} = 0.72$ was obtained. The value of the test coefficient reliability of 0.72 can be stated that the learning outcomes test of 20 items has high reliability. The large correlation coefficient between 0.6 to 0.8 can be interpreted as high value[6]. This shows that the instruments used in this study have adequate levels of reliability to measure the measured aspects. Although several measurements were used, the results are the same or relatively the same. Reliability testing is done to determine the consistency of an instrument study[7].

3.2 Hypothesis testing
The normality test and homogeneity test is carried out first before hypothesis testing is carried out. The formulated hypothesis will be tested with parametric statistics[5]. The use of parametric statistics requires that the data of each variable analysis must be normally distributed and both data must be homogeneous. The results of the prerequisite test can be seen in Table 2 below.

| Score     | The prerequisite test          |
|-----------|--------------------------------|
|           | Normality test                  | Homogeneity test                  |
| Pre-test  |                                |                                |
| Eksperiment class | $9.30 < 11.07 \Rightarrow$ normal | $1.63 < 1.95 \Rightarrow$ homogeneous |
| Control class         | $6.13 < 11.07 \Rightarrow$ normal          |
| Post-test           |                                |                                |
| Eksperimen class    | $5.65 < 11.07 \Rightarrow$ normal          | $1.23 < 1.95 \Rightarrow$ homogeneous |
| Control class      | $6.69 < 11.07 \Rightarrow$ normal          |

The intended hypothesis test was used to determine whether there is an effect of the hybrid learning model implementation to the learning outcomes of students in the experimental class. The results of the calculation and analysis of the data above then obtained the price of $t_{count} > t_{table}$ which is 2.130 > 2.036 so that the alternative hypothesis $H_a$ was accepted and the null hypothesis $H_0$ was rejected. Thus it can be concluded that there is the effect of the hybrid learning model implementation on thermochemistry to the student learning outcomes.

3.3 The effect of hybrid learning model implementation to the student outcomes, activities and responses
The control class and the experimental class received the same teaching materials, such as powerpoint files, lecturer presentations, hand-out, question enrichment, and videos. The difference is in the provision of teaching materials. The control class was given materials directly at the end of the learning process. While the experimental class teaching material was provided through e-learning so that it could
be accessed anytime and anywhere. Availability of e-moderating facilities in e-learning has given opportunity to lecturers and students to communicate easily through internet. The communication activities were carried out without being limited by distance, place and time. The role of students also changes from usually passive to active and relatively more efficient, for example, those who are far away.

Based on the results of the calculation of pre-test data and post-test data, there are significant differences in the mean values between the control class and the experimental class. The results of data processing that have been done using the t-test then there is the effect of applying the hybrid learning model to student learning outcomes in thermochemistry. Figure 1 shows the average of student learning outcomes in thermochemistry.

![Figure 1. The average of student learning outcomes in chemistry](image)

Figure 1 shows the average of pre-test and post-test. The average of pre-test in the experimental class and the control class did not have a significant difference. This means that students’ initial knowledge of thermochemistry was relatively the same. After given a difference in treatment, the post-test average results in the experimental class were higher by 10 points than the control class. This shows an influence on the application of the hybrid learning models in thermochemistry. Experimental class students who used the hybrid learning model had significant improvement and also showed success in improving students' cognitive abilities.

The effect of the hybrid learning model implementation on learning outcomes depends on several factors. In the control class conducted in person where the lectures and discussions happened in class only, while the experimental class used a hybrid learning model, meaning combining learning/lectures with e-learning class. The hybrid learning model is complementary to the lack of face-to-face learning and e-learning models. The weaknesses of e-learning learning included students and teachers physically challenged so that face-to-face interactions were reduced. Through face-to-face learning teachers are able to function themselves as educators and provide direct motivational encouragement.

Observation of the control class student activities was carried out when the classroom face-to-face learning, while observations of the experimental class student activities were carried out when face-to-face learning/traditional learning and during online discussion forums. After observing the control class and the experimental class, there were differences in the percentage of student activities which can be seen in Figure 2.
Figure 2. The activities percentage result.

Figure 2 shows the difference in the percentage of both classes activities. One of the reasons was caused by the existence of support for the online discussion forums for the experimental class which was the syntax of hybrid learning. Online discussion forums were given for 3 days, during each meeting students were given 3 questions, students were also given the opportunity to answer these questions from 8 AM – 8 PM. All students who took part in online discussions and participated in answering questions will appear in the logs view.

Online discussion forums hold an important role in increasing student activity because this forum is an information forum and facilitates interaction between lecturers and students. The easiness to accessing the forum is one reason online discussion forums facilitate interaction, because it can be accessed anywhere and anytime. The discussions conducted by students through e-learning media proved that they were increasingly active in looking for the sources of events around them. These activities showed the characteristics of the hybrid learning model.

Classically the percentage of student responses to thermochemistry by applying the hybrid learning model that was equal to 83.93% gives positive responses included in the excellent category, shown in Figure 3.

Figure 3. The percentage of student responses in hybrid learning.

In other words, the application of hybrid learning models to thermochemical subject can increase student activity and participation. Students were familiar with e-learning, knowing how to use e-learning and easy e-learning access. Students agreed that the material provided by lecturers in e-learning could help learning process when faced by difficulties. Online discussion forum helps students gain new knowledge.
4. Conclusion
Based on the results of the study, it can be concluded that the application of the hybrid learning model affecting student learning outcomes on thermochemistry. The hybrid learning model increases student activity. Student responses to learning through the hybrid learning model implementation increased to 83.93%. This shows a positive response.

References
[1] Sudibjo A and Wasis 2013 Penggunaan media pembelajaran fisika dengan e-learning berbasis edmodo blog education pada materi alat optik untuk meningkatkan respons motivasi dan hasil belajar siswa SMP Negeri 4 Surabaya Inovasi Pendidikan Fisika 02 187
[2] Dwi P and Putra A 2015 Pengembangan sistem e-learning untuk meningkatkan keterampilan berpikir kritis mahasiswa pendidikan fisika J. Fis. Indones 19 45
[3] Hendrayati H and Pamungkas B 2016 Implementasi model hybrid learning pada proses pembelajaran mata kuliah statistika ii di prodi manajemen Fpeb Upi J. Penelit. Pendidik 1 181
[4] Syarif I 2012 Pengaruh model blended learning terhadap motivasi dan prestasi belajar siswa SMK J. Pendidik. Vokasi 2 234
[5] Sugiyono 2010 Statistika untuk Penelitian (Bandung: Alfabeta)
[6] Arikunto S 2012 Dasar-Dasar Evaluasi Pendidikan (Jakarta: Bumi Aksara)
[7] Arikunto S 2012 Prosedur Penelitian: Suatu Pendekatan Praktek (Jakarta: Bumi Aksara)
[8] Budiharti R, Ekawati E Y, Pujayanto P and Wahyuningsih D 2015 Penggunaan blended learning dengan media moodle untuk meningkatkan kemampuan kognitif siswa SMP J. Cakrawala Pendidik 1 140