Direct instruction model assisted with PhET and Whatsapp to students’ cognitive and motivation

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Abstract. This research aims at understanding the influence of the direct instruction learning model assisted with PhET and WhatsApp media to students’ cognitive and motivation in studying gas kinetic theory at State Senior High School 3 of Banda Aceh. The population in this study was all science department students at year 11 divided into 5 classes. While the sample of the study was two classes that were selected using a random sampling technique. Data were collected by providing test and non-test. The obtained data were normal and homogeneous. Thus, it can be analyzed using the t-test to measure learning outcomes. To indicate the difference between experimental class and control class, it was used the t-test for questionnaire. Pretest has \( t_{\text{pretest}} = 1.27 \) which its value is less than \( t_{\text{table}} \). In conclusion, there is any significant difference between the experimental class and the control class. In addition, both classes revealed the same difference for the pretest. The posttest also showed the significant difference according to \( t_{\text{posttest}} = 5.5 \) which is greater than \( t_{\text{table}} \). Therefore, it can be concluded that there is any difference, which students’ cognitive experimental class is greater than the control class.

1. Introduction

The kinetic gas theory is one of the chapters in physics subject which is concerned about the collision theory among dynamic molecules with different rates. It forces students to understand the physics concepts about ideal gasses. This theory is one of the materials considered as a difficult one indicated by students’ quiz scores was 76 in State Senior High School 3 Banda Aceh at year 11 2017. Many factors that influence the learning outcomes; one of them is motivation. Motivation is mental strength which encourages the learning process. Learning activities will not be conducted without motivation [1]. Motivation can be distinguished into two types the motivation that comes from inside and outside as a form of encouragement or stimulus for everyone to push them to do something [2]. To improve student cognitive skills, it can be provided by arranging for a better learning process. Fun learning can motivate students to be more active during teaching-learning activities. Many things can be done to motivate students, one of them is the application of learning media. WhatsApp deals with various media in one application, for example, someone can send several types of files in the form of electronic books, photos, and other media.
Many researchers studied the use of WhatsApp application for learning physics to measure the motivation and learning outcomes of students [3]. Also, the research about WhatsApp has done to measure critical thinking of students [4], and the use of the WhatsApp group as a communication and learning tool [5]. Furthermore, they are interested in using PhET media in the learning process. In PhET, there is theoretical and practical stimulation accompanied by active users [6].

One learning model that can be used in learning of kinetic gas theory is direct instruction assisted with learning media. This model will help students to gain information and study basic skills [7]. PhET and WhatsApp can be used for this learning media.

2. Methods
This research used a quantitative approach. The kind of this research was applied research with the experimental method and pretest-posttest control group design. The design consisted of two groups that were randomly selected and then were given pretest to indicate the initial skills and the difference between experimental class and control class.

The population of this research was 170 students from 5 science department class in year 11. The sampling technique of this study used random sampling, in which two classes from five classes at were chosen as the research sample. Class 5 was as experimental class and class 4 was the control class. The total sample in this study was 68 students. The instruments of data collection used in this study were 25 multiple choice questions and 40 questionnaire items about the motivation statement.

The model provides a basis with which researchers can examine how external factor influence belief, attitude and intention to technology. According to the TAM model, users’ actual use of technology is influenced by one’s behavioral intentions, attitude, perceived usefulness, perceived ease of use.

3. Results and Discussion

3.1. Students Learning Outcome
Students’ learning outcomes for both experimental and control class in terms of pretest-posttest can be seen from the difference of pretest score compared to the posttest score obtained before and after learning. The following chart is students’ learning outcomes.
Based on chart 1, the average score of pretest in the experimental class is lower than the average score in the control class. However, having given the treatment, the average score of experimental class (taught by the assistance of PhET and WhatsApp media model) was higher than the average score in class control (taught without the assistance of the media model). The assistance of the media model of PhET and WhatsApp model was applied in learning can improve students' understanding. This is because learning through PhET is a form of abstract physics that can be simulated directly on the laptop. Learners can also discuss learning material outside of learning hours by utilizing the WhatsApp application that has been in the form of group chat [8].

Students’ learning outcomes were increased concerning the kinetic gas theory. It is due to students’ interest in participating in the direct instruction learning model assisted by PhET and WhatsApp media which can be seen from the students’ questionnaire statement on the attention indicator which reached 81.17%. Learning with the help of learning media can facilitate students in understanding and mastering physics concepts. The result of hypothesis testing indicated that the application of the direct instruction model assisted by PhET and WhatsApp media was more effective in improving students’ learning outcomes compared to the application of the direct instruction model without the help of PhET and WhatsApp media.

### 3.2. Students Learning Motivation

Students’ learning motivation was measured by using a motivational questionnaire that has been tested previously. There are 40 items of questions in which 20 items of question are positive statements and 20 items of question are negative statements. The purpose of this questionnaire was to measure students’ motivation. Learning motivation of students has same rate in both experimental and control classes before learning with the direct instruction model assisted by PhET and WhatsApp media applied.

The comparison of students’ learning motivation before and after the direct instruction model assisted with PhET and WhatsApp media in the experimental and control class were carried out using the t-test. The results of data analysis can be seen in the table below.

| Table 1. Average Score of Students’ Learning Motivation. |
|----------------------------------------------------------|
| **Sources**  | **Class** | **Average** | **Variant** | **t\text{test}** | **t\text{table}** | **Decision** |
|----------------------------------------------------------|
| **Pretest**  | Experiment | 113.31 | 172 | 1.12 | 1.67 | No |
| Control | 109.87 | 112.45 | 112.45 | different |
| **Posttest** | Experiment | 130.87 | 65.39 | 6.29 | 1.67 | Strongly |
| Control | 111.43 | 154.86 | 154.86 | different |

Based on the data analysis of t-test, the score of motivation for both experimental class and control class obtained \( t_{\text{test}} < t_{\text{table}} \) which was 1.12 <1.16. It indicated that there was no difference between the experimental class and the control class. While, the final motivation of experimental class and control class was attained \( t_{\text{test}} > t_{\text{table}} \), which was 6.29 > 1.67; this implied that there were differences related to motivation between two classes.

Learning motivation of students can be grouped into three categories namely low, medium and high [9]. The increase of students’ learning motivation based the group of its category before and after learning can be seen in the chart below [10].
Based on chart 2, it can be seen that the students' motivation before learning was conducted using the assistance of PhET and WhatsApp media model was not motivated to learn physics. Having learned using PhET and WhatsApp media students' experience increased significantly. This makes new learning experiences for students [11]. They also like to have discussions that take place outside of class hours using group chat on WhatsApp to ask learning materials that have not been understood in the classroom.

4. Conclusions
Based on the result and analysis from the data are obtained show that there are significant differences, between pretest and posttest scores from both experimental and control classes. Hence, it can be concluded that the application of the direct instruction model with the help of PhET and WhatsApp media can increase student’s cognitive and motivation. It is suggested that the teacher should apply the DI model with help of PhET and WhatsApp media to plan the time allocation for more discussion activities using PhET so that it can further improve students’ cognitive and motivation.

5. References
[1] Saiful B D 2008 Psikologi Belajar (Jakarta: Rineka Cipta)
[2] Peggy S 2016 The effects of direct intrusion procedures with a place value chart and model-lead-test error correction to teach regrouping with three-digit subtraction accuracy: A case study disabilities International Journal of English and Education 5 391402
[3] Tawil M 2017 Developing students’ creativity through computer simulation based learning in quantum physics learning International Journal of Environmental & Science Education 8 18291845
[4] Nitza D and Roman Y 2016 WhatsApp messaging: Achievements and succes in academia International Journal of Higher Education 5 25526
[5] Noah F 2006 High-tech tools for teaching physics: The physics education technology project Journal of online Learning and Teaching 2 510
[6] Sari D P, Tjanarakina and Kuntjoro S 2017 Applying science learning PhET simulation to improve process skill and knowledge aspect of junior high scholl student. Jurnal Penelitian Pendidikan Sains 7 14961500
[7] Lefudin 2017 Belajar dan Pembelajaran (Yogyakarta: Deepublish)
[8] Pratama H and Kartikawat S 2018 The effect of WhatsApp as mobile learning integrated with group investigation method of learning achievement International Journal of Science and Applied Science: Conference Series 2 164-173
[9] Azwar S 2003 Penyusunan Skala Psikologis (Yogyakarta: Pustaka Pelajar)
[10] Keller J 2000 How to Integrate Learner Motivation Planning Into Lesson Planning: The ARCS Model Approach. Florida: Florida State University
[11] Supurwoko S, Cari C, Sarwanto S, Sukarmin S and Suparmi S 2016 The effect of PhET Simulation media for physics teacher candidate understanding on photoelectric effect concept In International Journal of Science and Applied Science: Conference Series 1 1 33-39