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To cite this article: N Fitriyana et al 2018 J. Phys.: Conf. Ser. 1097 012064

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Fostering of students’ self-regulated learning and achievement: a study on hydrocarbon hybrid-learning and android-based-game

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Abstract. The use of particular media, hybrid of the video conference, android-based-game, and the combination between the two in the chemistry teaching-learning has been analyzed. The use of these media was applied on the subject of hydrocarbon in two aspects of students’ self-regulated learning and students’ achievement. A quasi-experiment with the posttest only design was employed in this study. The data of students’ self-regulated learning was collected through questionnaire, and those of the students’ achievement was collected through hydrocarbon test. The population was the students of 11 public senior high school in Purworejo regency, Central Java, Indonesia. A total of 72 eleventh grade students were cluster randomly selected from a public senior high school in those regency. Three different classes of samples were set, namely Class CG-1 using android-based-game only, Class CG-2 using hybrid of the video conference only, and Class E using both android-based-game and hybrid of the video conference. The data are tested according to Multivariate Analysis of Variance (MANOVA) technique and it was found that there is a significant difference in both aspects of the three classes. This study offers insights on the use of android-based-game and hybrid of the video conference to foster the students’ self-regulated learning and achievement.

1. Introduction

A rapid development of science and technology nowadays has been giving a great advantage to the world, especially in the education field. The science and technology development can be used as a media in the teaching-learning process for example in the chemistry subject. Many students regard chemistry as a difficult subject [1]. Hydrocarbon is one of the chemistry lesson which is considered as difficult one by the students. The combination of letters and numbers in hydrocarbon lesson make students regard hydrocarbon as abstractness concept [2] so that the appropriate learning media needed to make students learn hydrocarbon easier. One of the media should be used nowadays is Information, Communication, and Technology (ICT) based media.

The utilization of ICT-based media in the teaching-learning process offer an innovative method to exercise students’ self-regulated learning [3]. One of them in the use of hybrid learning, a learning which combines face-to-face and online phase, so that the teaching-learning can take place wherever and whenever. The result of the [4] work showed that the use of hybrid learning is found to be more effective and efficient than conventional teaching-learning. One of the media can be used in the online phase of hybrid learning is video conference. Video conference is very similar to formal classroom
teaching and therefore includes a very important process teaching element compared to all the distance teaching technologies available [5]. The use of video conference in the online phase of hybrid learning requires students to have good self-regulated learning skills. The use of video conference in online phase of hybrid learning is expected to support the process of students’ self-regulation by providing learning assistance to the students in terms of supervising, integrating, and evaluating the learning process, especially when the students are given a task. The result of [6] work revealed that the use of video conference can improve about 50% students’ self-regulated learning skill. Unfortunately, the use of video conference as the media in the education field not commonly used [7].

In addition of the used video conference, a learning management system can be used to support in the online phase of hybrid learning. The use of learning management system can support the learning tools of students [8]. The learning management system could facilitate students to access the teaching-learning material readily in flexible way. The students can learn the teaching-learning material that not be mastered anytime and anywhere.

On the other hand, an android-based game can also be used as an ICT-based media in the teaching-learning process. Educational game can upgrade the students’ motivation by adding game rules or competition into the learning activities [9]. The role of educational games could provide many opportunities for students to learn more interesting so that gives a positive influence towards students’ achievement. The presence of educational games which used in this study is very close to the students because it found in the android-mobile phone so that this media can facilitate students self-regulated learning.

Overall, the android-based-game and video conference on hybrid learning could facilitate students in learning process. This research not only help the students in learning process but also provide an alternative to enhance students’ self-regulated learning and achievement. Hence, this article concerned to analyze the differences of using media of android-based-game and hybrid of the video conference in the chemistry learning toward the aspects of students’ self-regulated learning and students’ achievement on hydrocarbon lesson.

2. Methods
2.1. Research design
The research design adopted for this study was a quasi-experiment with the posttest only design. The study seeks to analyze the differences of students’ self-regulated learning and students’ achievement through hydrocarbon teaching-learning in the class CG-1 using android-based-game only, class CG-2 using hybrid of the video conference only, and Class E using both android-based-game and hybrid of the video conference. This study focuses on comparing the use of ICT-based media so that no control class was used as the comparison of hydrocarbon teaching-learning without ICT-based media. The research design can be seen in Table 1.

<table>
<thead>
<tr>
<th>Class</th>
<th>Experimental Manipulation</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compared Group 1 (CG-1)</td>
<td>A₁</td>
<td>B₁, B₂</td>
</tr>
<tr>
<td>Compared Group 2 (CG-2)</td>
<td>A₂</td>
<td>B₁, B₂</td>
</tr>
<tr>
<td>Experiment (E)</td>
<td>A₃</td>
<td>B₁, B₂</td>
</tr>
</tbody>
</table>

Note: A₁=hydrocarbon teaching learning mediated by android-based game only; A₂=hydrocarbon hybrid learning mediated by video conference only; A₃= hydrocarbon hybrid learning mediated by video conference and android-based-game; B₁= self-regulated learning questionnaire; B₂= hydrocarbon test.

2.2. The Research Samples
The population of this study was all the eleventh grade students of 11 public senior high school in Purworejo regency, Central Java, Indonesia. The sampling technique was two steps of cluster random sampling. The first step was to choose the school while the second step was to establish the research
samples. For the purpose of this study, as many as 72 students were clustered randomly selected from a public senior high school in those regencies. The sample were classified into three different classes, class CG-1 of 26 students, class CG-2 of 22 students, and class E of 24 students.

2.3. The Instruction Process
The study was conducted in the first semester of eleventh high school grades of 2017/2018 academic year on the chemistry subject of hydrocarbon lesson. The hydrocarbon teaching-learning was fulfilled in 5 sessions. In class E and CG-2 was used hydrocarbon hybrid learning in the form of the combination between face-to-face and online phase. While in the CG-1 was used conventional teaching-learning on the subject of hydrocarbon thus the teaching-learning only conducted in face-to-face phase. In the face-to-face phase was used learning cycle 5E model. The syntax of the learning cycle 5E model consist of engage, exploration, explanation, elaboration, and evaluation stages. At the final session of this study, each class was given the scale of self-regulated learning and hydrocarbon test. The different instruction process among the three classes showed in the Table 2.

Table 2. The instruction process among the three classes

<table>
<thead>
<tr>
<th>Hybrid learning phase</th>
<th>Class E</th>
<th>Class CG-2</th>
<th>Class CG-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st, 2nd, and 3rd sessions</td>
<td>Learning cycle 5E</td>
<td>Learning cycle 5E</td>
<td>Learning cycle 5E with individual task and the feedback on the next meeting.</td>
</tr>
<tr>
<td>Face to face</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online</td>
<td>Individual task and feedback using learning management system.</td>
<td>Individual task and feedback using learning management system.</td>
<td>-</td>
</tr>
<tr>
<td>4th session</td>
<td>Learning cycle 5E</td>
<td>Learning cycle 5E</td>
<td>Learning cycle 5E with the task about model of hydrocarbon isomerism, feedback on the next meeting.</td>
</tr>
<tr>
<td>Face to face</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online</td>
<td>Task about the hydrocarbon isomerism model then presented via video conference. The feedback was given directly.</td>
<td>Task about the hydrocarbon isomerism model then presented via video conference. The feedback was given directly.</td>
<td>-</td>
</tr>
<tr>
<td>Face to face</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online</td>
<td>Continue presentation about hydrocarbon isomerism model via video conference.</td>
<td>Continue presentation about hydrocarbon isomerism model via video conference.</td>
<td>-</td>
</tr>
</tbody>
</table>

2.4. Data collection tools
The data collected in this study were students’ self-regulated learning and students’ achievement. Students’ self-regulated learning data was obtained through self-regulated learning questionnaire and those of the students’ achievement was obtained through hydrocarbon test. Both data collection tools were self-developed. The self-regulated learning aspects were synthesized from the various aspects of self-regulated learning level from [3, 10, 11, 12, 13]. The self-regulated learning questionnaire consisting of 15 points of statements (4 modification points of Likert scale, from 1= never to 4= always). While the students’ achievement was collected through hydrocarbon test consisting of 25 points of multiple choice and 4 points of essay posttest. Both, the self-regulated learning questionnaire and the hydrocarbon test were validated in two steps. The first was content validation by two lecturers.
covered aspects of content, construct, and language. The content validation of self-regulated learning questionnaire was conducted by asking the judgments from the expert of Psychology Department, while the hydrocarbon test from the Chemistry Education Department. The second was empirical validation by testing the data collection tools against eleventh grade students. The empirical validation of self-regulated learning questionnaire was tested against 243 students while the hydrocarbon test was tested against 122 students. Based on the analysis of data collection tools it was found that the Cronbach’s Alpha value of self-regulated learning questionnaire and hydrocarbon test were 0.72 and 0.95 respectively. According to [14] the Cronbach’s Alpha reliability coefficient of self-regulated learning questionnaire was in an acceptable category while the hydrocarbon test was in a very good category. Thus, these two data collection tools is a good instrument to collect the data of students’ self-regulated learning and achievement.

2.5. Data Analysis
Multivariate Analysis of Variance (MANOVA) with prerequisite test of multivariate normality and covariance matrix equality was used to analyze the differences of students’ self-regulated learning and students’ achievement in these instructional model.

3. Results and Discussion
The use of ICT based media, android-based-game, hybrid of the video conference, and the combination between the two in the chemistry teaching-learning gives a positive effect toward students’ self-regulated learning and students’ achievement. The use of these media was conducted on hydrocarbon lesson. The result of MANOVA technique revealed a significant difference on the students’ self-regulated learning and students’ achievement among the three classes in these instructional model (P-value of Roy’s Largest Root test 0.000 < 0.05). The significant differences on both aspects were caused by the different media employed in those hydrocarbon teaching-learning. In the class E and CG-2 was employed hybrid learning in the form of face-to-face and online phase of teaching-learning. In the online phase of hybrid learning was used the video conference which provide a learning process which is similar to face-to-face learning in the classroom. The used of the video conference provide direct interaction process between the teacher and the students so that it looks like the face-to-face teaching-learning. Moreover, the video conference expanding the teaching-learning access thus the teaching-learning process was conducted in a very flexible way. In addition, the use of learning management system was supported on the online phase of hybrid learning. The learning management system provide the teaching-learning material so that students can access the material wherever they want. The result of this study confirmed the previous study conducted by [15, 16, 17, 18] which show that the online phase of hybrid learning can improve the students’ self-regulated learning.

Moreover, the use of android-based-game enrich the knowledge and enthusiasm of the students. In the class CG-1 and E (in addition of the used hybrid learning) was used the android-based-game as the media in the teaching-learning process. The present of the android-based-game was very close to the students because it found in android mobile phone and the students bring they own anywhere. The android-based-game consist of the competence should students mastered, hydrocarbon materials, and the exercise of hydrocarbon materials in the form of game rules. The exercise in the form of game rules makes students more motivated to learn hydrocarbon. The result of this study agrees with findings of [19, 20] that the used of game in the form of mobile learning had positive influence towards students’ academic performance.

The online phase of hybrid learning in this study was used as supplemental which could facilitate students’ flexible way to learning. The students can learn the materials wasn’t being mastered anywhere and anytime. Moreover, the result on Test of Between Subject Effects to know the differences in each aspect of those students’ self-regulated learning and students’ achievement was observed as shown in Table 3.
Table 3. Test of between subject effects

<table>
<thead>
<tr>
<th>Aspects</th>
<th>P value</th>
<th>Conclusion*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students’ self-regulated learning</td>
<td>0.001</td>
<td>Significantly different</td>
</tr>
<tr>
<td>Students’ achievement</td>
<td>0.013</td>
<td>Significantly different</td>
</tr>
</tbody>
</table>

*computed using alpha 0.05

According to Table 3, it can be concluded that there was a significant influence of the instructional model towards students’ self-regulated learning and students’ achievement. However, different result was obtained by the Post Hoc test. The result of Post Hoc test showed that the significant difference of students’ self-regulated learning was found between class CG-1 with the other two classes. However, for students’ achievement, the difference was found between class CG-2 with the other two classes. The comparison of average score for students’ self-regulated learning among the three classes can be seen in Figure 1.

Based on Figure 1, the highest scores of students’ self-regulated learning was obtained by class CG-1. The results indicate that the use of android-based-game as hydrocarbon teaching-learning media was equally good toward students’ self-regulated learning. According to the work of [21], the self-regulated learning aspects such as setting goal and monitoring learning process was found as the success key of students’ game-based-learning. The android-based-game can be utilized as flexible independent learning sources compared to the other media. This study confirm the previous study conducted by [22] which showed that the used of mobile educational games provide a significant impact towards students’ self-regulated learning. On the other hand, the comparison of average achievement score among the three classes in these instructional model can be seen in Figure 2.

Figure 1. The comparison of self-regulated learning score

Figure 2. The comparison of achievement score
Based on Figure 2, it can be concluded that the use of hybrid learning was equally good toward students’ achievement. The use of video conference and learning management system as the online phase of hybrid learning gives a significant influence towards students’ achievement. The online phase of hybrid learning provide students well prepare to learn the materials in the face-to-face teaching-learning. These fact leads the students to have higher students’ achievement score which confirmed of the work [23, 24] that the addition of online phase gives a positive influence to the students’ achievement. An online learning phase provides additional learning time, instructional learning sources, and course elements that promote the interactions among the students [25]. So that the students’ achievement in the class CG-1 which used hybrid learning was equally good.

In general, the self-regulated learning strategies by students in the form of efficient learning planning, monitoring the learning process, and adjusting the attitude to the experienced learning situation will increase the students’ performance. Several studies found that the self-regulated learning skill have a positive role to improve students’ achievement [26, 27, 28] and students’ academic adjustment [29]. However, based on the result of this study, the self-regulated learning skill isn’t a good predictor toward students’ achievement. In fact, there is an aspect of students’ self-regulated learning was unfulfilled which is in the implementation phase. Many students can’t control themselves, they have less attention when the online phase of hybrid learning is in progress. The students still can access the teaching-learning material wherever they want so they can freely to learn the hydrocarbon material that could make the less attention in the teaching-learning occurred. This fact leads the students’ self-regulated learning is a weak predictor toward students’ achievement.

4. Conclusion
There is a significant influence of the android-based-game, hybrid of the video conference, and combination between the two towards students’ self-regulated learning and students’ achievement. The result of this study indicated that the used of android-based-media was equally good towards students’ self-regulated learning while the used of hybrid learning mediated by video conference was equally good towards students’ achievement. The android-based-game is an interactive media that can be utilized as flexible independent learning sources. While the hybrid learning mediated by video conference make the students freely to repeat the material which has not been mastered and provide a well prepare to learn the materials in the face-to-face chemistry learning instruction. Thus, the used of both media should be potentially to further use as the media in the hydrocarbon teaching-learning to foster students’ self-regulated learning and students’ achievement.

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**Acknowledgments**

Financial support from the Kemenristek Dikti (Indonesian Directorate General of Higher Education) was received in this work through “Tim Pascasarjana” Research Grant 2017 with the contract number of 19/Penel./P.Tim Pascasarjana/UN34.21/2017.