Natural Science Visual Model Videos for Online Learning: Effect on Students' Achievement

A S Adam¹, T A Ansyah¹, W Rohmawati¹, *Parno¹, E Purwaningsih¹

¹Department of Physics, Faculty of Mathematics and Natural Science, Universitas Negeri Malang, Malang 65145, Indonesia

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ABSTRACT

Natural Science is a subject on junior high school level, consist of Physics and Biology. As the characteristic of contextual, natural science has many parts to be explained by observation, presenting the real object both in reality or virtually. As the pandemic era, the learning process difficult to held the real presenting, and virtual approach is the answer of this challenge. Video is one of the teaching and learning media for online learning. In visual model, the video completes with the visualization of particular process or particular object which difficult to direct observe like planets in universe. Furthermore, this particular study aimed to measure the students' achievement and compare to traditional learning held in offline setting. The students' achievement represents with the final test in the end of semester. The variables measured in a whole semester with 119 students in junior high level. Besides, the semester with videos for online learning compare to the achievement in the offline semester on same students. As the results, the students' achievement with the set of visual model videos better than the traditional instruction. After more, this finding can use as the alternative method in online learning due to the continuing pandemic era in Indonesia with extend the study from home program.

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INTRODUCTION

As the common discussion, natural science consists of Physics, Biology, and Chemistry. That three sciences can be explained in one scope to explain the natural phenomena in a real life. For instructional purpose, natural science teaches in junior high level as natural science. However, it didn't complete with chemistry, contain physics and biology in integrated way. As the contextual science, natural science—in scope of junior high level, need a real tool for gaining the full understanding on particular concept. As the observational process, more sense makes more information, connecting each other, and produce a complete understanding—called as constructivist learning (Goldman et al., 2012). Many constructivists learning approach reported succeed in many experiences with various condition. There is the positive effect of constructivist learning approach on student's academic achievement have been included in the meta-analysis study (Ayaz & Sekerci, 2015), 3D virtual environment facilitates the students to gaining the learning outcome through constructivist learning approach (Chau et al., 2013), Constructivist learning model has the positive effect on students' achievement and scientific thinking on 8th grade in natural science course (Qarareh, 2016), and many more. The constructivist learning theory view thinking process built by connecting the new information to the previous knowledge

(Adam, 2007). According to the constructivist theory students should have interact to the meaningful activities due to the prior experience (Schunk, 2012).

Constructivist learning can be experience in virtual media (Chau et al., 2013). The virtual media bring the real-world phenomena to the multimedia, make the essential process of particular phenomena show in multi-dimensional media. One of the common multimedia in daily life is video. Visual model is a graphic representation of a blueprint, both of real or imaginative idea. Visual model video means the graphic representation on particular science concept or natural phenomena complete with the motion of that process. It means bring the essential information of natural science concept in a video. Furthermore, it provides the students chance to learn from unreal object, but gain the actual concept. However, students still have the opportunities to think in constructivist—connect the previous knowledge to the new information (Misra, 2020). One of the potential concepts on natural science in junior high level is the universe, contain the information on sun, planets, and other outer space thing. Then, that visual model complete with teacher's explanation about important space phenomena. The visual model video captured as the Figure 1 below.

Figure 1. Visual model of Venus.

Online learning is the more recent long-distance learning which improve to the student ability and give them ability to interact with the teacher (Jethro et al., 2012). It means, the online learning not only focus on how to learn on teacher and students on a long distance, but also the environment on them, interact each other, and the quality of the process. In online leaning, the teacher didn't give the information in one way, teacher give the feedback about students' responses. Therefore, only visual model video as the learning media is inappropriate to the online learning setting. As this experiment, use Learning Management System (LMS) to complete the outcome of the online learning.

The interactive online learning could be the online learning should be. In this pandemic era, students in Indonesia should study at home, with online setting. Moreover, this setting appropriate to the government program in education called "*merdeka belajar*". This mean "free in learning", which gives the student opportunities to manage their learning style, stressed release by pay more attention on passion, and more attention to the subject they like most (Abidah et al., 2020). As this information, there is the encourage system on the recent condition and government program in education, give an opportunity to apply innovative ways as visual model video. As the part of the solution in pandemic era, this particular study aimed to describe the students' achievement in natural science lesson on junior high school's students and compare this result to the previous learning model (offline), which done as more traditional way in learning process. In this study, students' achievement is represented by the final semester exam.

RESEARCH METHOD

The subject of this particular study is the 8th grade of junior high school level students, consist of a whole level of 119 students in a school on Batu, East Java. The students' achievement gain from the final semester exam in the end of 2020 as the online learning, and the semester before as the offline learning/traditional learning. Both of final exam consist of Physics and Biology in a same portion and same characteristic on both semesters. Furthermore, online learning done by the using of visual model video on many chapters in it and use the constructivist approach by the using of LMS as the interactive media. While offline learning done with traditional learning, but use the presentation media like *PowerPoint*. Furthermore, the flowchart of the research procedure shows in Figure 2.

Figure 2. Flowchart of the research procedure.

This article is a part of quantitative method. The data obtained from the score of the final exam in each semester. The final exam consists of 40 question with same quality on each semester. After more, the attainment score can be analyzing in descriptive quantitative with the minimum score of 75 based on the government regulation (Kemendikbud, 2017). Students' achievement score compares between the online and offline, use Mann-Whitney Test as the non-parametric statistic due to the non-homogeneous and non-normal data.

RESULTS AND DISCUSSION

Before the t test is carried out, the data is tested whether it meets the normality and homogeneity requirements. If it does not meet, then the data will be tested with a nonparametric t test. But in this case, the data is not normally distributed. Furthermore, the data were not normally distributed too. Based on these two conditions, the data analysis continue to the non-parametric statistics of Mann-Whitney Test.

The Mann-Whitney rank test is a form of testing in nonparametric statistical analysis, where the test is used to test the similarity of the distribution of two independent populations, assuming the distribution of the two populations is continuous and as the result of the data analysis, it can be concluded that There is a difference in value between online and offline learning. The nonparametric statistical analysis shows in the Table 1.

Table 1. The Mann-Whitney rank test result of the students' achievement of the two groups.

Group	N	Mean	Asymp. Sig. (2-tailed)
Offline	120	76,19	,000
Online	123	83,66	

Based on the Table 1, the mean value of the online group using LMS and visual model video greater than the value of offline group. Furthermore, the Asymp. Sig value less than 0,05 means that there is the difference between the students' achievement of online and offline group. Besides, the result of this study was divided into two expertise fields, that are (1) The use of video media in online learning, (2) Improvement of conceptual understanding.

The use of video media in online learning

There are several strategies carried out by teachers in online learning system to increase students' interest to learn during the pandemic era. Media is one of the most important elements in learning (Hattie, 2016). This study utilizes media in the form of interactive videos to assist teachers in delivering science learning material. The use of interactive video, not only facilitates the delivery of material but can also increase the effectiveness in achieving learning goals and increase students' motivation (Guido, 2018; Iqmaulia, 2019). After being applied in learning, the advantages of online learning that utilize interactive video are attractive, affordable in terms of financing, easy to use, available, and useful. It helps achieve learning objectives if the media used has high absorption in delivering material and provides understanding to students. This result is related to several other studies which suggest that student learning outcome for online learners were as good as or better than traditional learners regardless of background characteristics that the students were greatly satisfied with online learning (Jacobs, 2013; Dziuban et al., 2015; Laine, 2017).

In this experiment, visual model video not only for one chapter in a whole semester but also in several chapter. As the universe system, visual model appropriate to use as the characteristic of the concept. Many space objects are impossible to use in a real object—There is no recent technology for record each planet in universe system clearly. Many planets' picture maybe can be observed directly on telescope, but for the instructional purpose a clear quality picture bring the students' attention for learn more. Furthermore, the visual object in this video consists of a whole solar system, planets, asteroids, comets, and even the sun and moon eclipse process—sun, earth and moon position on eclipse.

Improvement of conceptual understanding

Assessment is an activity carried out to determine the level of progress or development of students after carrying out the learning process at a certain time (Deeley, 2018). Comparing the offline and online scores was done to determine the difference in students' conceptual understanding. That activity is carried out not only to identify the online learning results but also to evaluate the effectiveness of methods, media, learning strategies applied by teachers, to increase student interest and motivation. Increasing student motivation is directly proportional to the increase in conceptual understanding. The data categorized into the lower and upper score based on the minimum score level in school. The student who has the score less than 75 categorized into lower score, then the student who has the score 75 and up categorized into upper score. The detail score attainment show in Figure 3.

Figure 3. Offline and online score charts.

The results of the data analysis showed a significant increase between the offline scores compared to the online scores. The Offline and online score charts shows that there is improvement of students' conceptual understanding before and after being taught by online learning using visual model video. The data was strengthened with the level of significance both test which had been analyzed by using Non-parametric t-test. Therefore, the comparison of the mean offline and online scores of students increased from 84.79 to 87.62 for the average score of 75 and above. The results indicate that the students' conceptual understanding improve significantly after being taught through the online learning using the visual model video.

As the result of this experiment, the visual model video can be the alternatives media of the online learning in pandemic era. The video conference needs more internet data—as the effect of unavailable public internet connection in this country. Visual model video is a one-time download, for unlimited playable time if students' need to learn many times. Furthermore, the interactive part of this online learning style fulfills with a help of LMS for giving instruction, and teacher's feedback on students' learning achievement.

Therefore, the satisfaction of this result come from the new approach of the online learning. Compared to other subject, the use of visual model video only applies in natural science subject and identified as the aspect of motivation increasing. This particular research needs farther studies as many aspects relating to the learning process and transform to the limitation of this studies. Need analyze the comprehensive aspect relating to the visual model video use for further the next research.

Furthermore, the development of the visual model video should follow the suggestion for further integration of many students' aspect. As example, many learning media found make the cognitive load (Brame, 2016). Many things have to do for reduce the cognitive load level are use the signaling to highlight the information, use segmenting to divide the information, use weeding to erase the unimportant information, and use the combination between the audio and visual.

On the other hand, there are some challenges in the visual model video using. First, the visual model video using in some integration learning model should investigated as the characteristic of the learning media. The learning media help to succeed the learning aim in particular learning method. As the fact that the good result of online learning with visual model video is the good indication for this learning media integration. Besides, the video using can combine with the blended or hybrid learning as the pandemic condition. Second, the using of visual model video should make the comprehension analysis due to gain the learning objection effectively. Third, the video development should pay attention to the content and the element of the video.

CONCLUSION

This study shows that the learning strategy which utilizes video media successfully supports online learning at the junior high school level on Natural Science subject. Online learning using visual model video tend to change the face of education to be better, more effective, and more enjoyable. Teachers are becoming increasingly innovative in packaging teaching materials and are increasingly creative in developing learning methods to attract student enthusiasm. However, it is necessary to readjust with the various abilities of each teacher and student in providing this online learning facility, so that the obstacles experienced can be minimized. This result is indicated by a significant increase in online scores when compared to offline scores. This result indicates that the use of visual model video can be the good supporting media while integrate to other learning setting. Furthermore, this particular study doesn't deal with the other aspect in students' condition as the cause of the result of the visual model video using. Hence, the other aspect relating to the learning process should be investigated in the future research.

REFERENCES

- Abidah, A., Hidaayatullaah, H. N., Simamora, R. M., Fehabutar, D., & Mutakinati, L. (2020). The impact of Covid-19 to Indonesian education and its relation to the philosophy of "Merdeka belajar". *Studies in Philosophy of Science and Education*, 1(1), 38-49.
- Adams, N. B. (2007). Toward a model for knowledge development in virtual environments: Strategies for student ownership. *International Journal for Social Sciences*, 2(2), 71-77.
- Ayaz, M. F., & Sekerci, H. (2015). The effects of the constructivist learning approach on student's academic achievement: A meta-analysis study. *Turkish Online Journal of Educational Technology-TOJET*, 14(4), 143-156.
- Brame, C. J. (2016). Effective educational videos: Principles and guidelines for maximizing student learning from video content. *CBE – Life Sciences Education*, 15(4), es6.
- Chau, M., Wong, A., Wang, M., Lai, S., Chan, K. W., Li, T. M., ... & Sung, W. K. (2013). Using 3D virtual environments to facilitate students in constructivist learning. *Decision Support Systems*, 56, 115-121.
- Deeley, S. J. (2018). Using technology to facilitate effective assessment for learning and feedback in higher education. *Assessment & Evaluation in Higher Education*, 43(3), 439-448.
- Dziuban, C., Moskal, P., Thompson, J., Kramer, L., DeCantis, G., & Hermsdorfer, A. (2015). Student satisfaction with online learning: is it a psychological contract?. *Online Learning*, 19(2), n2.
- Goldman, S. R., Braasch, J. L., Wiley, J., Graesser, A. C., & Brodowinska, K. (2012). Comprehending and learning from Internet sources: Processing patterns of better and poorer learners. *Reading research quarterly*, 47(4), 356-381.
- Guido, R. M. D. (2018). *Attitude and motivation towards learning physics*. ArXiv Preprint ArXiv:1805.02293.
- Hattie, J. A., & Donoghue, G. M. (2016). Learning strategies: A synthesis and conceptual model. *Npj Science of Learning*, 1(1), 1-13.
- Iqmaulia, K., & Usman, O. (2019). Needs influence, reward, interest and motivation learning environment on learning motivation in higher education. SSRN. <https://doi.org/10.2139/ssrn.3510181>
- Jacobs, P. (2013). The challenges of online course for the instructor. *Research in Higher Education Journal*. (1)2. 1-16.
- Jethro, O. O., Grace, A. M., & Thomas, A. K. (2012). E-learning and its effects on teaching and learning in a global age. *International Journal of Academic Research in Business and Social Sciences*, 2(1), 203.
- Kemendikbud. (2017). *Panduan penilaian oleh pendidik dan satuan pendidikan Sekolah Menengah Pertama*. Kemendikbud.
- Laine, E., Veermans, M., Lahti, A., & Veermans, K. (2017). Generation of Student Interest in an inquiry based mobile learning environment. *Frontline Learning Research*, 5(4), 42-60.

- Misra, P. K. (2020). Implications of constructivist approaches in the classrooms: The role of the teachers. *Asian Journal of Education and Social Studies*, 17-25.
- Qarareh, A. O. (2016). The effect of using the constructivist learning model in teaching science on the achievement and scientific thinking of 8th grade students. *International Education Studies*, 9(7), 178-196.
- Schunk, D. H. (2012). *Learning theories an educational perspective sixth edition*. Pearson.
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Author (s):

Alif Syaiful Adam

Department of Physics, Faculty of Mathematics and Natural Science,
Universitas Negeri Malang,
Jl. Semarang No.5, Sumbersari, Kec. Lowokwaru, Malang 65145, Indonesia
Email: alifsyaifuladam@gmail.com

Tomy Andre Ansyah

Department of Physics, Faculty of Mathematics and Natural Science,
Universitas Negeri Malang,
Jl. Semarang No.5, Sumbersari, Kec. Lowokwaru, Malang 65145, Indonesia
Email: tomyandreansyah@gmail.com

Widya Rohmawati

Department of Physics, Faculty of Mathematics and Natural Science,
Universitas Negeri Malang,
Jl. Semarang No.5, Sumbersari, Kec. Lowokwaru, Malang 65145, Indonesia
Email: widrohrawati@gmail.com

* Parno (Corresponding Author)

Department of Physics, Faculty of Mathematics and Natural Science,
Universitas Negeri Malang,
Jl. Semarang No.5, Sumbersari, Kec. Lowokwaru, Malang 65145, Indonesia
Email: parno.fmipa@um.ac.id

Endang Purwaningsih

Department of Physics, Faculty of Mathematics and Natural Science,
Universitas Negeri Malang,
Jl. Semarang No.5, Sumbersari, Kec. Lowokwaru, Malang 65145, Indonesia
Email: endang.purwaningsih.fmipa@um.ac.id