The Effect of Students' Learning Motivation toward Retention in Biology Learning Using Augmented Reality-based Media

Badrut Tamam [1] [*], Aida Fikriyah [1]
[1] University of Trunojoyo Madura, Bangkalan, East Java
[*]E-mail: badruttamam@trunojoyo.ac.id

Abstract

This research aims to examine the effect of students' learning motivation to retention in biology learning. This research is included in quantitative research. The research sample was 56 students. To measure learning motivation, the ARCS (Attention, Relevance, Confidence and Satisfaction) motivation questionnaire was used which was adapted from Keller (2010) with a total of 36 statements. Retention was measured using an essay test which was carried out 2 weeks after the posttest. Student answers were then measured using Hart's (1994) rubric. A simple linear regression analysis was carried out to see the effect of students' learning motivation toward retention. The results of data analysis show that there is a significant effect of students' learning motivation toward the retention. Based on the regression results, it is known that the R value is 0.654, which indicates that there is a correlation in which a strong relationship between motivation and retention. Motivation has a contribution of 42.8% to retention and 57.2% is influenced by other factors. It can be concluded that learning motivation can encourage working memory performance so that the flow of information can be processed in the long-term memory.

Keywords: augmented reality, effect, motivation, retention

INTRODUCTION

Motivation is indicated by intensity, purpose, and persistence in efforts to achieve goals (Dai & Sternberg, 2004). According to Keller (2010), motivation determines a person's desires, work to be done, and commitment to what is to be done. Motivation is a psychology that awakens a student to initiate and persist in an action to achieve the desired goal (Aluja-Banet et al., 2017). Motivation is an element to react and fulfill learning needs (Gopalan et al., 2017).

Kim & Frick (2011) state that the main principle in efficient education is to encourage student motivation. Schunk et al. (2014) said that motivation can influence all phases of learning and performance. DePasque & Tricomi (2015) stated that motivation regulates neural responses to performance related to feedback, supporting learning and memory. Cognitive theory emphasizes that motivation can help direct attention and influence how information is processed (Schunk et al., 2014).

According to Di Serio et al. (2013), Thealls survey shows that there are six motivation factors, namely: inclusion, attitude, meaning, competence, leadership and satisfaction. Keller proposed four factors, namely: attention, relevance,

confidence, and satisfaction. According to Keller (2010), Attention is a process in an effort to generate attention and maintain students' attention during learning. Keller (2010) states that there are three indicators of attention, namely perceptual arousal, inquiry arousal and variability. Relevance is an activity that links learning with the needs of students, this aims to ensure that students have a positive attitude towards learning (Keller, 2010). Relevance has three indicators, namely, goal orientation, motive matching, and familiarity (Keller, 2010).

Confidence is an activity to foster a sense of self-confidence in students, fostering confidence that students will be able to succeed in learning (Keller, 2010). Confidence has three indicators, namely learning requirements, success opportunities, and personal control (Keller, 2010). Satisfaction is an effort to generate a sense of satisfaction with learning (Keller, 2010). Satisfaction has three indicators, namely natural consequences, positive consequences, and equity.

Retention is an important indicator of learning. The effectiveness of learning can be seen from the student's ability to process and store the information received within a certain period of time. According to Ekoningtyas (2013); Tamam & Corebima (2023), retention is closely related to students' ability to store and reveal science concepts again within a certain time interval after participating in learning. Ausubel (2011) defines retention as the process of gaining actual meaning from the learning material presented.

Retention or good memory is related to the ability to store information in memory, which is what every student needs for optimal learning. Memory is the sum total of what we remember, and gives us the ability to learn and adapt from previous experiences and build relationships (Zhang, 2019). Memory is the ability to encode, store, and then recall information and past experiences in the human brain (Preston & Wagner, 2007).

According to Alison (1999), Schunk et al. (2014), and Chang et al. (2012), there are three types of memory, namely sensory memory, short-term memory and long-term memory. Sensory memory functions to receive information input through the senses. Next, the information goes into short-term memory. Short-term memory is working memory that has a limited capacity to encode, retrieve, and practice information in a short period of time (Schunk et al., 2014; Chang et al., 2012). Short-term memory then processes the information to be stored in long-term memory by rehearsing the information repeatedly or to retrieve information from long-term memory by recalling previous knowledge. Long-term memory is a store of extensive knowledge and records of previous events (Cowan, 2008; Tamam & Qomaria, 2023).

In fact, studies on Indonesian students' learning motivation show that students' motivation to study biology is still low (Chotimah, 2015). This low motivation is caused by several factors, including: 1) target achievement is limited to graduating and working so there is minimal desire to

achieve, 2) biology subjects are not subjects that are tested at the national level, and 3) biology subjects are not productive subjects (Chotimah, 2015). Likewise studies on retention, the research results of Wicaksono (2011), Firdaus (2015), and Setiawati (2015) show that the level of learning retention is still low. The results of the PISA study (2018), the science learning outcomes of Indonesian students are still in the low performance quadrant. The survey results regarding science skills are linked to retention, because the tests in the survey were carried out suddenly in order to obtain real results.

Based on the background above, a study was carried out between motivation and retention in biology learning. The research aims to see the effect of motivation on retention in biology learning using Augmented reality-based learning media. It is hoped that the results of this research can make a significant contribution to the development of appropriate learning by encouraging learning motivation to empower retention. Apart from that, it can also provide useful information for the development of the education curriculum.

METHOD

This type of research is quantitative research. The research population was state high school students in Pamekasan. The research sample was chosen randomly and a sample of 56 students was obtained. Instrument to see retentionuse essay tests that are valid and reliable. The test is given two weeks after the posttest on learning results is given. The test is carried out for 90 minutes. The test results are then measured using Hart's rubric (1994) on a scale of 0-4. Motivation was measured using a modified questionnaire from ARCS (Keller, 2010) with 36 items using a scale of 0-5. Motivation questionnaire instruments were given before and after biology learning using AR. The instruments used have gone through an expert validation process, empirical validation and are reliable. The reliability table can be seen below in table 1.

Tabel 1. Results of instrument reliability analysis

Items	Cronbach Alpha	Note
Attention	0.722	Reliable
Relevance	0.781	Reliable
Confidence	0.802	Reliable
Satisfaction	0.705	Reliable

To know the effect of learning motivation toward retention used linear regression analysis. Analysis was carried out using SPP 25 for windows. Before the data was analyzed, the data met normality and data homogeneity (motivation was 0.600 and retention was 0.887, reliable). To determine the strength of the relationship, the analysis results are then interpreted based on Table 2.

Tabel 2. Interpretation of Relationship Coefficients

Coefficient Interval	Relationship Level
0.000-0.199	Very low
0.200-0.399	Low
0.400-0.599	Currently
0.600-0.799	Strong
0,800-1,000	Very strong

RESULT AND DISCUSSION

The research data consists of data on learning motivation (variable x) and student retention (variable y). The results of descriptive analysis show that the mean of motivation and retention data is 66.05 and 66.85, the median of motivation and retention data is 63.85 and 66.30 with standard deviations of 7.79 and 10.80 respectively (See Table 3).

Tabel 3. Descriptive analysis results

	Motivation	Retention
N	56	56
Mean	66.05	64.85
Median	63.85	66.30
Std. Deviation	7.79	10.08

A summary of the simple linear regression analysis between motivation and learning retention in biology learning is presented in Table 5 to Table 7. Based on the ANOVA summary results, it is known that the calculated F value is 38.121 with a significance value of $0.000 < \alpha\ 0.05$. This shows that there is a significant influence between learning motivation and retention in biology learning.

Furthermore, it is also known that the regression coefficient is 0.833 and the constant is 10.479. The form of influence can be presented in the regression equation Y = 10.479+ 0.833X. The results of the data analysis also show that the R value is 0.654, which means that motivation and retention have a strong influence. The R Square value is 0.117, this shows that motivation has a contribution of 42.8% to retention and 57.2% is influenced by other factors.

Data in table 4, table 5, and table 6 shows the summary of ANOVA correlation between students' learning motivation and retention.

Tabel 4. Correlation between student motivation and retention

Model	Sum of Square	Df	Mean Square	F	Sig.
Regression	2187.205	1	2187.205	38.121	,000
Residual	2926.17	51	57,376		
Total	5113.382	52			

Tabel 5. Correlation Regression Coefficient between student motivation and retention

Model	Unstandardized Coefficient		Standardized Coefficients	Q	Sig.
	B	Std. Error	Beta		
(Constanta)	10,4	8,973		1,168	,248
Motivation	,833	.135	,654	6,174	,000

Tabel 6. Summary of Linear Regression Results between Student Retention Motivation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.654a	,428	,417	7.57470

Based on the results of data analysis, it is known that there is significant effect of learning motivation toward the retention. The influence of motivation on biology learning outcomes is 42.8%. This finding is in line with the study of Murty & Dickerson (2016) which states that motivation has a significant effect on memory. Furthermore, Murty & Dickerson (2016) states that motivation is the core of human behavior.

Motivation influences the decisions made, the experiences sought, and will impact what we encode and remember.

This finding is also supported by findings of Duan, Fernández, van Dongen, & Kohn (2020) stated that motivation has a significant influence on improving memory performance. Motivation influences the use of appropriate cognitive strategies. Several study results show that achievement motivation is a variable that influences the performance of high achieving students, including working memory (Trigo et al., 2018). Furthermore, Wischgoll et al. (2019) also stated that the more complex the working memory task, the higher the level of motivation. Study by Wongupparaj et al. (2018) shows that motivation in general drives a person's mental performance. It was further stated that there was a significant positive relationship between the learning motivation and performance efficiency on working memory tasks.

Santrock (2011) states that motivation is a process that can provide enthusiasm, direction and persistence in a person's behavior. Thus, students who have high motivation will show active behavior in the learning process. According to Crosling, Heagney, & Thomas (2009), active involvement of students in the learning process will increase retention. Student involvement in the learning process causes students to be more able to comprehend biology subject matter more deeply.

Another factor is student attention during the learning process. Amin &

Malik (2013) stated that attention is one of the factors that influences retention. Good attention will help students in the selection of information to be encoded in memory. Chun & Turk-Browne (2007) state that attention determines what will be encoded and adaptation helps improve memory encoding. Attention is a component of motivation (Keller, 2010).

CONCLUSION

Based on the research results, it can be concluded that there is the significant effect of students' learning motivation toward the retention. This shows that motivation has an important role in working memory to encourage the information received to be processed into long-term memory. The implication of this research is that it is necessary for teachers to build students' learning motivation in biology learning so that the information received during learning can be included in long-term memory.

REFERENCES

Aluja-Banet, T., Sancho, M.-R., & Vukic, I. (2017). Measuring motivation from the Virtual Learning Environment in secondary education. Journal of Computational Science. https://doi.org/10.1016/j.jocs.2017.03.007

Ausubel, D. P. (2011). The Acquisition and Retention of Knowledge: A Cognitive View. Dordrecht; London: Springer.

Chang, T.-W., Kinshuk, Chen, N.-S., & Yu, P.-T. (2012). The effects of presentation method and information density on visual search ability and working memory load. Computers & Education, 58(2), 721–731. https://doi.org/10.1016/j.compedu.2011.09.022

Chotimah, H. (2015). Penerapan strategi pembelajaran think pair share untuk meningkatkan motivasi belajar biologi siswa kelas x-KPR-2 SMKN 13 kota Malang. Jurnal Biology Science & Education, 4(1), 18–28.

Chun, M. M., & Turk-Browne, N. B. (2007). Interactions between attention and memory. Current Opinion in Neurobiology, 17(2), 177–184. https://doi.org/10.1016/j.conb.2007.03.005

Cowan, N. (2008). Chapter 20 What are the differences between long-term, short-term, and working memory? In Progress in Brain Research (Vol. 169, pp. 323–338). Elsevier. https://doi.org/10.1016/S0079-6123(07)00020-9

Dai, D.Y., & Sternberg, R.J. (Eds.). (2004). Motivation, emotion, and cognition: Integrative perspectives on intellectual functioning and development. Lawrence Erlbaum Associates.

DePasque, S., & Tricomi, E. (2015). Effects of intrinsic motivation on feedback processing during learning. NeuroImage, 119, 175–186. https://doi.org/10.1016/j.neuroimage.2015.06.046

Di Serio, Á., Ibáñez, M.B., & Kloos, C.D. (2013). Impact of an augmented reality system on students' motivation for a visual arts course. Computers & Education, 68, 586–596. https://doi.org/10.1016/j.compedu.2012.03.002

Duan, H., Fernández, G., van Dongen, E., & Kohn, N. (2020). The effects of intrinsic and extrinsic motivation on memory formation: insights from behavioral and imaging studies. Brain Structure and Function, 225(5), 1561–1574. https://doi.org/10.1007/s00429-020-02074-x

Ekoningtyas, M. (2013). Pengaruh Pembelajaran Think-Pair-Share Dipadu Pola Pemberdayaan Berpikir melalui Pertanyaan terhadap Keterampilan Metakognitif, Berpikir Kreatif, Pemahaman Konsep IPA dan Retensinya serta Sikap Sosial Siswa. Jurnal Pendidikan Sains, 1(4), 332–342.

Firdaus, I. (2015). Pengaruh penggunaan model pembelajaran biologi berbasis inkuiri terhadap hasil belajar dan retensi siswa kelas X SMAN Kota Pasuruan [Skripsi Tidak Diterbitkan]. Universitas Negeri Malang.

Gopalan, V., Bakar, JAA, Zulkifli, AN, Alwi, A., & Mat, RC (2017). A review of the motivation theories in learning. 020043. https://doi.org/10.1063/1.5005376

Keller, J. M. (2010). Motivational Design for Learning and Performance: The ARCS Model Approach. Springer US. https://doi.org/10.1007/978-1-4419-1250-3

Kim, K.-J., & Frick, T. W. (2011). Changes in Student Motivation During Online Learning. Journal of Educational Computing Research, 44(1), 1–23. https://doi.org/10.2190/EC.44.1.a

Murty, V. P., & Dickerson, K. C. (2016). Motivational Influences on Memory. In Advances in Motivation and Achievement (Vol. 19, pp. 203–227). Emerald Group Publishing Limited. https://doi.org/10.1108/S0749-742320160000019019

Preston, A. R., & Wagner, A. D. (2007). The medial temporal lobe and memory. Neurobiology of Learning and Memory, 305–337. doi:10.1016/b978-012372540-0/50010-8

Schunk, D., Meece, J.R., & Pintrich, P.R. (2014). Motivation in Education Theory, Research and Applications (fourth). Pearson.

Setiawati, I. (2015). Pengaruh strategi reading questioning and answering terhadap minat baca, keterampilan metakognitif, hasil belajar biologi, dan retensi siswa SMA Kota Malang [Tesis Tidak Diterbitkan]. Universitas Negeri Malang.

Tamam, B., & Qomaria, N. (2023). Implementation of Augmented Reality in Biology Learning: Its Effect on Learning Motivation and Retention. Journal of Educational Research and Evaluation, 7(1), 17-22. https://doi.org/10.23887/jere.v7i1.59038.

Trigo, J.M., Soliman, A., Quilty, L.C., Fischer, B., Rehm, J., Selby, P., Barnes, A.J., Huestis, M.A., George, T.P., Streiner, D.L., Staios, G., & Le Foll, B. (2018). Nabiximols combined with motivational enhancement/

cognitive behavioral therapy for the treatment of cannabis dependence: A pilot randomized clinical trial. PLOS ONE, 13(1), e0190768. https://doi.org/10.1371/journal.pone.0190768

Wicaksono, A. G. C. (2011). Pengaruh strategi pembelajaran reciprocal teaching dipadu dengan jigsaw terhadap kemampuan metakognitif, hasil belajar, dan retensi siswa kelas X di SMA Negeri 7 Malang. [Skripsi Tidak Diterbitkan]. Universitas Negeri Malang.

Wischgoll, A., Pauli, C., & Reusser, K. (2019). High levels of cognitive and motivational contingency with increasing task complexity results in higher performance. Instructional Science, 47(3), 319–352. https://doi.org/10.1007/s11251-019-09485-2

Wongupparaj, P., Sumich, A., Wickens, M., Kumari, V., & Morris, R. G. (2018). Individual differences in working memory and general intelligence indexed by P200 and P300: A latent variable model. Biological Psychology, 139, 96–105. https://doi.org/10.1016/j.biopsycho.2018.10.009

Zhang, J. (2019). Cognitive Functions of the Brain: Perception, Attention and Memory. ArXiv, abs/1907.02863. http://arxiv.org/abs/1907.02863

BRIEF PROFILE

Badrud Tamam as the first author is a senior lecturer at Natural Science Education, University of Trunojoyo Madura who is expert in Technology-based Learning Media. Furthermore, Aida Fikriyah as the second author is a lecturer at Natural Science Education, University of Trunojoyo Madura who has expertise in Science Learning Media.