Unnes.J.Biol.Educ. 12 (1) (2023)

Journal of Biology Education

http://journal.unnes.ac.id/sju/index.php/ujbe

The Effectiveness of Mobile Apps Based Interactive Multimedia to Improve Students' Conceptual Understanding

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Info Artikel

Article History:

Received: January 2023

Accepted: January 2023

Published: April 2023

Keywords:

Concept understanding , human digestive system, interactive multimedia, mobile apps

Abstract

Online learning impairs student's understanding. Students need interactive learning media without space and time limitations. The purpose of this study was to analyze the effectiveness of the interactive multimedia of the human digestive system based on mobile apps to increase students' understanding and to analyze the profile comparison of their conceptual understanding. This research employed nonequivalent control group design, XI MIPA 1 as the experimental class and XI MIPA 2 as the control. Data were explored by test instruments and questionnaires. There was a significant difference in the average learning outcomes in the experimental class compared to the control class (81.8 > 76.1). The increased understanding of concepts in the experimental class and the control were moderate and significantly different (N-gain 0.63 > 0.48). The experimental class reached classical completeness (88.89%). The profile of understanding the concept of the experimental class is higher than the control on all indicators. The experimental class and the teacher responded very good to the multimedia. The conclusion of this study is that the interactive multimedia of the human digestive system based on mobile apps is effective for increasing students' understanding and the profile of students' conceptual understanding in the experimental class is higher than that of the control.

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p-ISSN 2252-6579
e-ISSN 2540-833X

INTRODUCTION

Implementation of distance learning or online learning due to the Covid-19 pandemic 19 in the even semester of the 2021/2022 school year at SMA N 1 Jakenan, Pati Regency, carried out via the WhatsApp Group and Microsoft Teams. In online learning the interaction between teachers and students was not optimal, causing students to not be able to fully master the material. This is due to the limited duration of the lesson hours, which was originally two hours of 90 minutes, reduced to 50 minutes. The teacher only shared material in the form of PPT or YouTube links accompanied by brief discussions and giving assignments to students. During the online learning, students are less actively involved and less enthusiastic. Students are also careless in sending assignments from teachers. The results of a student questionnaire regarding the online learning process found that all students who were respondents felt bored. In addition, learning media that were less varied and less interactive make students less interested in the learning process.

Biology subject is also considered difficult because it has quite a lot of material and there is a perception that students feel they have to memorize the material without knowing the interrelationships between the materials in biology lessons. Biology subjects in concepts of physiological bioprocesses are not only about memorizing but requiring deeper understanding. Class XI of the human digestive system is one of the concepts that require conceptual understanding as it explain the relationship between organ structure and function in relation to nutrition, bioprocess, and its disorders. As many as 45% of students at SMA N 1 Jakenan obtained learning outcomes under the KKM, this shows that students' conceptual understanding of this material tends to be low. Students are expected to be able to understand the concepts being taught, not just memorize concepts, so students can remember the concepts they have studied for a longer time and the learning will be more meaningful (Harahap & Ristiono, 2019). The meaning of learning is in accordance with the nature of student-centered learning which is influenced by constructivism theory, where knowledge cannot be simply transferred from teacher to student, but students are active in building their own knowledge through interaction, interaction with themselves and with the surrounding environment (Suparno , 2015).

Interest in learning and students' understanding of concepts that tend to be low during this pandemic, requires teachers to look for solutions. The teacher is expected to be able to assist students in increasing their interest in learning and understanding the concept of the human digestive system material. One effort that can be done by the teacher is to use learning media. Learning media is a teaching aid or helps communication and interaction between teachers and students (Arsyad, 2016). Learning will go well and provide optimum results if it is equipped with good learning media (Purba *et al.*, 2020). Therefore, teachers must be able to choose the appropriate learning media to convey knowledge and information properly.

The rapid development of technology provides many choices for the use of learning media for teachers and students. Based learning media *Information and Technology* (allows students to choose interesting and interactive media. One of the learning media that can be used is interactive multimedia. Interactive multimedia can contain various media such as text, images, graphics, sound, animation, and video at once, and can train students to be more independent and active in gaining knowledge (Munir, 2015). The use of interactive multimedia in learning aims to make students with different learning styles able to study the material properly. The key to student success in learning and gaining understanding of the material depends on the appropriate learning style (Bire *et al.*, 2014). The use of interactive multimedia can increase learning interest and attention in learning (Waruwu & Sitinjak, 2022). In addition, Manurung (2021) also stated that the use of interactive multimedia can stimulate students' thoughts, feelings, concerns, and desires so that they can encourage a more interactive and communicative learning process. Interactive multimedia can also be accessed online or offline without space and time limitations, so it is suitable for use as an online learning media that has limited lesson time duration.

In the online learning, smartphones are the core of learning for students. An application developed as interactive multimedia on *a* smartphone is mobile application or commonly referred to as a mobile application. Mobile apps are able to increase student involvement, ease access to knowledge, learn without boundaries and enable collaboration between students, teachers and parents (Alwi *et al.*, 2019). Mobile apps helps students be more interested in learning and can better understand the lessons of the human digestive system (Samsudin *et al.*, 2019). In this study, the analysis did not measure the increase and profile of students' conceptual understanding through the pretest posttest, so there is a need for an analysis of the increase and profile of students' conceptual understanding in the material of the human digestive system using interactive multimedia based on mobile apps to strengthen the findings. Based on interviews, teachers

at SMA N 1 Jakenan have not yet implemented learning media in the form of interactive multimedia. By using interactive multimedia based on mobile apps, it is hoped that students will be more interested in learning and students can study actively anywhere and anytime without space and time limits so that it makes it easier for students to increase their knowledge and understanding of the concept of the human digestive system material. Based on the description above, it is necessary to conduct research entitled "The Effectiveness of Mobile Apps Based Interactive Multimedia to Improve Students' Conceptual Understanding of Human Digestive System Material".

RESEARCH METHOD

This research was conducted at Jakenan 1 Public High School from March 25 to April 1, 2021. This is a quantitative research, with a quasi-experimental, nonequivalent control design. Sampling was done by purposive sampling technique. The samples used in this study were class XI MIPA 1 as the experimental class and XI MIPA 2 as the control class. The treatment in the two classes was distinguished; the experimental class used interactive multimedia based on mobile apps, while the control class used video. The learning model used in both classes is discovery learning. Data analysis was obtained using test instruments and questionnaires. Question sheets pretest and posttest involved 20 multiple choice items whose validity and reliability were tested based on the seven indicators of conceptual understanding according to Anderson *et al*. (2001) that is interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining. The results of pretest and posttest were analyzed using the normality test, the test for differences in the average learning outcomes, the classical completeness test, the N-Gain test, and the Independent sample t test. The results of student and teacher responses were analyzed descriptively.

RESULTS AND DISCUSSION

The results of the study were used to analyze and describe the results of the application of mobile apps to conceptual understanding students on the material of the human digestive system. Based interactive multimedia mobile apps that is applied to the experimental class can be accessed at the following link: https://drive.google.com/file/d/1Fszнd5Xi3HYYyCbN8rCnl8jUExEMh3HG/view?usp=sharing/
While in the control class the learning media that is applied is in the form of videos from YouTube which are can be accessed via the following link:
https://www.youtube.com/watch?v=eGV2AAfvG-A&t=49s and
https://www.youtube.com/watch?v=N0PS9OpNgvo&t=488s.

Figure 1. Initial Display of Multimedia Interactive

Figure 2. Display of Material Concept Categories

Normality Test

Based on the results of the normality test analysis, it is known that the *pretest-posttest* in the experimental and control class are normally distributed because the significance value in the Shapiro-Wilk column for both classes is more than 0.05 (Table 1). So it can be decided that the statistical test used to find out the difference in the mean is the parametric test.

Table 1. Results of Normality Test Data *Pretest-Posttest* Class Experiment and Control

Data	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	Df	Sig.
Pretest	Experiment	.097	36	.200*	.981	36	.790
Results	Control	.133	36	.111	.960	36	.216
Hasil	Experiment	.123	36	.186*	.962	36	.249
Results	Control	.138	36	.080*	.946	36	.080

Differences in Average of Experimental Class and Control Class

Based on the analysis of the research results it is known that the average pretest the control class is almost the same as the experimental class. After implementing the learning media, it was found that the average experimental class using interactive multimedia based on mobile apps was higher than the control class using YouTube videos. The average pretest-posttest the experimental and control classes is presented in Figure 3.

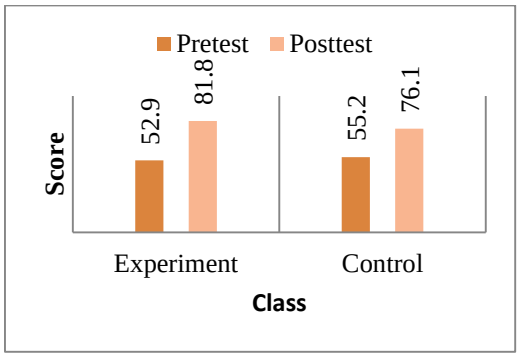


Figure 3. Mean Profile Pretest-posttest

Table 2. Mean Difference Test Results Pretest-posttest

Data		*Levene's Test for Equality of Variances*		*t-test for Equality of Means*		
		F	*Sig.*	*T*	*Df*	*Sig. (2-tailed)*
Pretest Results	*Equal variances assumed*	0.011	0.917	-0.584	70	0.561
	Equal variances not assumed			-0.584	69.809	0.561
Posttest Results	*Equal variances not assumed*	1.172	0.283	2.050	70	0.045
	Equal variances not assumed			2.050	67.476	0.045

The treatment was almost the same or did not show a significant difference, meaning that the initial abilities of the experimental class and the control class were the same (Table 2). This can happen because the ability of knowledge and material concepts of the human digestive system possessed in both classes is still basic, which was previously obtained in junior high school (SMP). After being given the treatment, it was found that there was a significant difference in the average learning outcomes between the experimental and control classes. This is in line with Sugiyono (2015) which states that the difference between learning outcomes before and after treatment is assumed to be the effect of the treatment. One very important factor for improving student learning outcomes is the use of instructional media (Audie, 2019). In this study the learning media applied to the experimental class were interactive multimedia based on mobile apps, while the control class only used learning videos from YouTube. This is in line with Kartini & Putra's research (2020) which reports that the results of implementing interactive learning media have a major influence on student learning outcomes.

Improvement of Students' Understanding of Concepts

Based on the analysis of students' learning outcomes before and after learning it is known that there is an increase in understanding of concepts in the experimental and control classes. The magnitude of the increase can be seen from the difference in the pretest and posttest test N-gain. Based on the N-gain students per individual, the increase in students' understanding of the concept of the experimental class was better than the control class. Many experimental class students get an increase in the medium category and many control class students get a fairly low category. In the experimental class there were no students who received the low category while in the control class there were still many students who received the low category (Table 3). This happened because the control class was not trained enough to work on questions that could build or construct understanding of concepts, while the experimental class was trained in the form of evaluation or practice questions on interactive multimedia.

Based on the results of the average N-gain analysis, it is known that the increased understanding of the concept of the experimental class is in the medium category and the control class is in the fairly low category (Table 4). Improved understanding of concepts average the experimental class is higher than the control class with a difference of 0.15. Even though it has a fairly thin difference, the results of the analysis of the average N-gain difference test show that there is a significant difference in increasing understanding of concepts between the experimental class and the control class (Table 5). This advantage occurs because of the influence of the application of interactive multimedia based mobile apps in the experimental class. This is in line with Muslichatun et al. (2021) which states that there is an effect of using Android-based interactive media on understanding concepts compared to learning using PowerPoint.

Table 1. Recapitulation of N-Gain Analysis Results Experiment Class and Control

Categories	Student Precentage (%)	
	Experiment Class	Control Class
High	22.22	16.67
Moderate	47.22	19.44
Fairy Low	30.56	41.67
Low	0	22.22

Table 4. Results of Analysis of the Average N-Gain Understanding of the Concept of Experiment Class and Control

Data	Class	Mean	Maximum	Minimum
N-Gain	Experiment	0.63	1	0.27
	Control	0.48	1	0.11

Table 5. Results of Analysis of Average Differences *N-gain* Class Experiment and Control

Data		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	T	Df	Sig. (2-tailed)
N-gain Results	Equal variances assumed	1.076	0.303	2.741	70	0.008
	Equal variances not assumed			2.741	65.518	0.008

The learning model used in the experimental class and the control class both used the *learning* so that there was an increase in understanding of concepts in both classes. This is in line with research conducted by Suprihatin et al. (2014) who showed that the application of discovery learning to the material of the human digestive system affects student learning activities and outcomes. Dafira & Widodo (2021) also stated that understanding concepts through teaching discovery learning has effectiveness on digestive system material. The application of the discovery learning for learning material on the human digestive system, the teacher refers to the syntax according to Syah (2017), namely, the stimulation phase, the problem statement phase, the data collection phase, the data processing phase, the verification. The five syntaxes form a learning cycle that is interconnected with one another. Activities in this syntax provide opportunities for students to find and prove information through discussion and provide experiences that make it easier for students to understand the concepts that have been obtained so that meaningfulness occurs in learning. The meaning of learning is influenced by constructivism learning theory, where knowledge cannot simply be transferred from the teacher to students, but students are active in building their own knowledge through interaction, interaction with themselves and with the surrounding environment (Suparno, 2010).

Concept Understanding Profile

Students' conceptual comprehension ability was measured by multiple choices. The questions refer to indicators of conceptual understanding according to Anderson *et al*. (2001) that is interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining. Students are asked to be able to analyze the nutrients needed by the human body and their sources and functions, compose a nutritionally balanced diet, identify the human digestive organs and their structures and functions, analyze the enzymes contained in each of the human digestive organs and function, comparing the digestive organs of humans and ruminants and analyzing the causes and efforts to prevent human digestive system disorders.

Based on the results of the analysis of increasing the ability to understand concepts in each indicator, it is known that the experimental class is superior in each indicator compared to the control class (Figure 4). This is in line with the research by Gunawan *et al.* (2016) which states that the average conceptual mastery of students who learn to use interactive multimedia is higher than students who learn without interactive multimedia. In the experimental class, the indicator with the highest increase is in the classifying indicator. This is because in the learning process students are trained to think in building the material concept of the human digestive system through games and an emphasis on material concepts so that it makes it easier for students to understand the material. Comparing indicator is the indicator with the lowest increase. This is because the concept of comparing that is trained on students is still incomplete so that students have not fully mastered the concept. In the control class, the indicator that obtained the highest increase was the summarizing indicator. Students are only asked to determine the correct statement from the reading that has been provided and choose the right way to prevent human digestive system disorders. The indicator with the lowest increase is in the inferring indicator. Students still have difficulty in determining the digestive process that occurs in an organ and the enzymes that work in that process. This is because there is no emphasis on concepts in the learning process so that students still have difficulty understanding them.

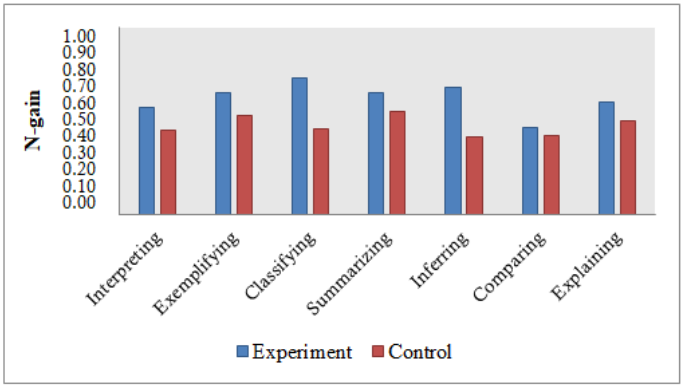


Figure 4. N-gain Profile per Indicator Understanding

Mastery of Classical Learning

Based on the results of the classical learning completeness analysis, it was found that the experimental class had studied classically, while the control class had not completed it classically (Table 6). A class is said to have completed its learning (classical mastery) if in the class there are ≥ 85% of students who have completed learning or have achieved the specified KKM (Trianto, 2011). The percentage obtained by the experimental class using interactive multimedia based on mobile apps has proven to be effective in increasing student scores in order to achieve the specified KKM. This is in line with Kartini & Putra's research (2020) which reports that the results of implementing interactive learning media have a major influence on student learning outcomes.

Table 6. Results of Analysis of Mastery of Classical Learning in Experiment Class and Control

Data		N	Completed	Persentage
Pretest Results	Experiment	36	7	19.44%
	Control	36	8	22.22%
Posttest Results	Experiment	36	32	88.89%
	Control	36	24	66.67%

Multimedia Interactive made based on mobile apps because all students have a mobile form of a smartphone. Smartphones are an effective medium for conveying information. In addition, smartphones are used in daily activities, including as a result of the Covid-19 pandemic which requires everyone to carry out their activities online, including students and educators. Ease of access and use of interactive multimedia based on mobile apps can also train students' independence in learning, thus minimizing the teacher's role in the learning process and creating a student centered learning without space and time limits. Interactive multimedia is also made based on basic curriculum to be achieved so that student learning outcomes can run optimally. Learning objectives can be achieved through the presentation of material and activities in interactive multimedia. Presentation of material in interactive multimedia is also conceptualized and interactive so that it makes it easier for students to achieve learning goals. Questions in interactive multimedia are tailored to the learning objectives to lead to the attainment of the desired concept.

Activities in interactive multimedia include student interactivity in learning such as drag and drop, matching and pairing games, testing food substances in a virtual laboratory, as well as evaluation activities or practice questions. The relationship of interactivity or student involvement with learning is very important in relation to the success of a lesson. According to Surjono (2017) interactivity is able to create a more optimal learning process because students can control or adjust the display speed of learning material through the navigation buttons on each frame. This is supported by research by Dharmayana & Shinta

(2019) which shows that the higher the academic involvement, the higher the learning achievement. Conversely, the lower the academic involvement, the lower the learning achievement.

Students Response

The results of the analysis of student responses in the experimental class showed that students responded from good to very good to the application of interactive multimedia based *mobile apps* to the material on the human digestive system. There were no students who gave moderate, poor or bad responses (Table 7). The results of the analysis of student responses per aspect show good results in all aspects with the highest acquisition successively covering aspects of learning activities, interactive multimedia content, understanding of concepts, and attractiveness, presented in Figure 5.

Table 7. Results of analysis of experimental class students' responses towards the application of interactive multimedia

Category	Number of Students	Percentage (%)
Very good	12	33
Good	24	67
Moderate	0	0
Not Good	0	0
Bad	0	0

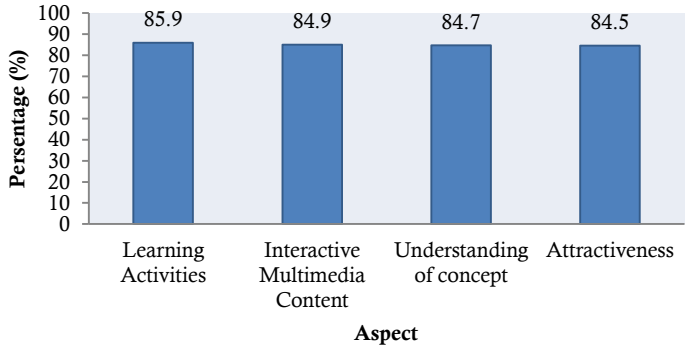


Figure 3. Percentage of student responses per aspect

The acquisition of student responses from good to very good is not directly proportional to students' understanding of concepts which only get medium category. This was caused by the reduction in learning time due to the Covid-19 pandemic, so that the learning model did not take place optimally. In data collection and data processing students cannot be maximized properly. Learning that is carried out online makes it difficult for teachers to monitor and review students directly in seeking information knowledge and finding answers to problems. In the data collection and data processing phases, this is actually the most important phase of the discovery learning where students are trained to grow knowledge and understanding of concepts through discovery (Hosnan, 2014). This phase is not fulfilled optimally so that it affects the understanding obtained. In other words, the activeness of students can affect their learning achievement. Learning that involves the activeness of students is able to improve learning achievement, the higher the involvement of students, the higher the learning achievement (Setyowati, 2021). Student participation in discussions is influenced by several factors including the courage to give responses, the courage to answer questions, the ability to explain, the ability to conclude, and the confidence to ask questions (Ginanjar *et al.*, 2019).

In online learning students are required to have more awareness of learning independently. This is because the material cannot be taught completely as a result of reduced study time. In addition,

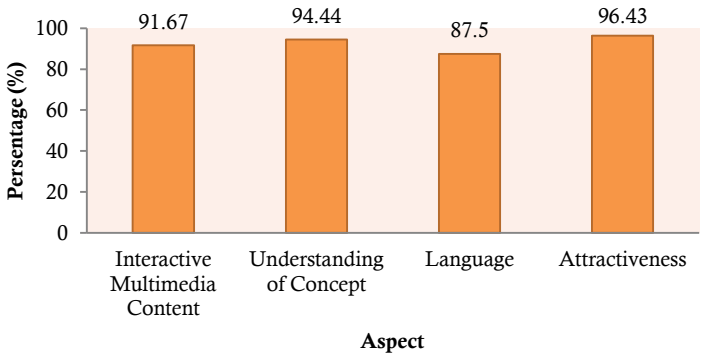
independent learning is also needed to reinforce the understanding that has been obtained. Gagne & Briggs (2008) explained that learning is the result of pairs of stimuli and responses which are then *reinforced* continuously *reinforcement* is intended to strengthen the behavior that is internalized in the learning process. Each person's learning process will produce different learning outcomes, so it needs *reinforcement* to experience changes in behavior for the better. Student learning independence also needs support from parents. Parents who give full attention and support to their children, the child's achievement will be better. In addition, factors that influence learning outcomes or understanding of concepts are internal factors and external factors (Dalyono, 2015). Internal factors include interest and motivation, intelligence or intelligence, health, and learning methods. External factors include family and school environment. The existence of good conditions, facilities, and infrastructure from the family and school is the capital for students to be able to carry out learning activities to the fullest. In addition, an unstable internet network causes students to go in and out of *rooms*, so they cannot take part in learning optimally.

Teacher Response

Based on the results of the analysis of the biology teacher's response to the application of *mobile apps* it was shown that the three biology teachers responded very well to the results of the individual analysis (Table 8). The results of the analysis of teacher responses per aspect also show very good responses in all aspects. The teacher gave the highest response successively on the aspects of attractiveness, understanding of concepts, interactive multimedia content and language (Figure 6).

Table 8. Results of analysis of teacher responses to the application of interactive multimedia based on mobile apps

Name	Score	Category
Teacher 1	93.3	Very good
Teacher 2	93.3	Very good
Teacher 3	95	Very good



Gambar 4. Teacher's Response for Each Aspect

The teacher stated that the pictures, animations, and videos used in interactive multimedia are appropriate and support learning activities student. In addition, the teacher also stated that the presentation of concepts in interactive multimedia was interesting, creative, fun and made it easier for students to understand material concepts and can be applied to other materials. The teacher also provides suggestions on interactive multimedia, namely learning media can be uploaded to the play store to make it more accessible to students, some videos are made offline to anticipate bad internet networks, and the addition of a "home" to the theory menu to return to the main material menu.

CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that the application of mobile apps based interactive multimedia is effective for increasing students' conceptual understanding of the human digestive system at SMA N 1 Jakenan and the profile of students' conceptual understanding in the experimental class is higher than the control class in all indicators.

DAFTAR PUSTAKA

Alwi, N. H. M., *et al*. (2019). Successful factors for teaching and learning using mobile applications. Dalam: *Proceeding International Conference on Business, Economy, Social and Technology (ICBEST)*, Malaysia, 27-28 April 2019. Malaysia: Asian Scholars Network. Hlm. 171-179.

Anderson, L. W., *et al*. (2001). *Kerangka Landasan untuk Pembelajaran, Pengajaran dan Asesmen (Revisi Taksonomi Pendidikan Bloom)*. Translated by Prihantoro, A. (2015). Yogyakarta: Pustaka Pelajar.

Arsyad, A. (2016). *Media Pembelajaran*. Jakarta: Raja Grafindo Persada.

Audie, N. (2019). Peran media pembelajaran meningkatkan hasil belajar peserta didik. Dalam: *Prosiding Seminar Nasional Pendidikan FKIP, 2*(1), 589–590.

Bire, A. L., *et al*. (2014). Pengaruh gaya belajar visual, auditorial, dan kinestetik terhadap prestasi belajar siswa. *Jurnal Kependidikan: Penelitian Inovasi Pembelajaran*, *44*(2), 168-174.

Dafira, I. S. & Widodo, W. (2021). Efektivitas model *discovery learning* berbasis digital terhadap pemahaman konsep materi sistem pencernaan manusia. *Pensa E-Jurnal*, *9*(2), 182–187.

Dalyono, M. (2015). *Psikologi Pendidikan*. Jakarta : PT. Rineka Cipta.

Dharmayana W., I., & Shinta A., L. (2019). Korelasi antara keterlibatan akademik dengan prestasi belajar siswa kelas X di SMK Negeri 1 kota Bengkulu. *Triadik.* 18(1), 66–74. https://doi.org/10.33369/triadik.v18i1.11387

Gagne, L. M., & Briggs, L. J. (2008). *Principles of Instructional Design, Second Edition*. New York: Holt Rinehart and Winston

Gunawan, G., *et al*. (2016). Pengaruh multimedia interaktif dan gaya belajar terhadap penguasaan konsep kalor siswa. *Jurnal Pendidikan Fisika Indonesia*, *12*(2), 118–125.

Harahap, F,. & Ristiono, R. (2019). Identifikasi miskonsepsi siswa SMP Negeri 15 Padang tentang materi sistem pencernaan makanan pada manusia menggunakan tes diagnostik *two tier multiple choice*. *Atrium Pendidikan Biologi*, *3*(1): 84–93.

Hosnan, M. (2014). *Pendekatan Saintifik dan Kontekstual dalam Pembelajaran Abad 21: Kunci Sukses Implementasi Kurikulum 2013*. Bogor: Ghalia Indonesia.

Kartini, K. S., & Putra, I. N. T. A. (2020). Pengaruh penggunaan media pembelajaran interaktif berbasis android terhadap hasil belajar siswa. *Jurnal redoks (Jurnal Pendidikan Kimia Dan Ilmu Kimia)*, *3*(2), 8–12.

Manurung, P. 2021. Multimedia interaktif sebagai media pembelajaran pada masa pandemi covid 19. *Al-Fikru: Jurnal Ilmiah*, 14(1): 1–12.

Munir, M. (2015). *Multimedia: Konsep & Aplikasi dalam Pendidikan*. Bandung: Alfabeta.

Muslichatun, M., *et al.* (2021). Analisis pemahaman konsep dan hasil belajar siswa dalam pembelajaran konsep rangka manusia berbantuan media interaktif berbasis android. *Jurnal Profesi Keguruan*, *7*(1), 142–150.

Purba, R.A., *et al.* (2020). *Pengantar Media Pembelajaran*. Medan: Yayasan Kita Menulis.

Setyowati, S. (2021). Korelasi Antara *Student Engagement* (Keterlibatan Siswa) dengan Prestasi Hasil Belajar Siswa dalam Proses Pembelajaran Daring Di Sekolah Menengah Kejuruan Negeri 1 Ngawi. Skripsi Jurusan Pendidikan Agama Islam Universitas Islam Negeri Maulana Malik Ibrahim. http://etheses.uin-malang.ac.id/id/eprint/27369

Samsudin, S., *et al*. (2019). *Mobile app education* gangguan pencernaan manusia berbasis multimedia menggunakan Adobe Animate CC. *Jurnal Teknologi Informasi*, *3*(2), 141-148. https://doi.org/10.36294/jurti.v3i2.1009

Sugiyono. (2015). *Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif, dan R&D)*. Bandung: Alfabeta.

Suparno, P. (2010). *Filsafat Konstruktivisme dalam Pendidikan*. Yogyakarta: Kanisius.

Suprihatin, Isnaeni, W., & Christijanti, W. (2014). Aktivitas dan hasil belajar siswa pada materi sistem pencernaan dengan penerapan strategi pembelajaran *discovery learning*. *Unnes Journal of Biology Education*, *3*(3), 275–282. https://doi.org/https://doi.org/10.15294/jbe.v3i3.4526

Surjono H. D. (2017). *Multimedia Pembelajaran Interaktif Konsep dan Pengembangan*. Yogyakarta: UNY Press.

Syah, M. (2017). *Psikologi Belajar*. Depok: Rajawali Pers.

Trianto, T. (2012). *Panduan Lengkap Penelitian Tindakan Kelas (Classroom Action Research) : Teori & Praktik*. Jakarta: Prestasi Putakarya.

Waruwu, A.B.C. & Sitinjak, D. 2022. Penggunaan multimedia interaktif dalam meningkatkan minat belajar siswa pada pembelajaran kimia. *Jurnal Pendidikan Mipa*, 12(2): 298–305.