

DEVELOPMENT OF MULTIMEDIA LEARNING BASED ON MACROMEDIA FLASH 8 AS A SOURCE OF SELF-LEARNING ON THE DIGESTIVE SYSTEM MATERIALS

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ABSTRACT

This study aims to determine the feasibility level of learning multimedia developed using Macromedia Flash 8 software on the food digestive system material as a source of student self-study based on the responses of material experts, media experts, field teachers, and students. This study uses a 4-D model of instructional development design, including the stages of definition, design, development, and dissemination, limited to the limited deployment stage to see students' classical learning completeness. This research was started in September 2020 – February 2021. The product trial was conducted at the GKPI Padang Bulan Private High School, Medan. The results showed that (1) learning multimedia developed using Macromedia Flash 8 software on the food digestive system material in humans had been compiled with input from validators, biology educators, and students; (2) the learning multimedia developed is considered suitable for use in biology learning in terms of the assessment of material experts with an average score of 4.5, media experts with an average score of 4.4, field of study teachers with an average score of 4.9, and students with an average score of 4.7; and (3) 97% of students completed learning the material on the human digestive system after using learning multimedia based on Macromedia Flash 8. As an implication, the developed learning multimedia is expected to help the biology learning process, whether online or face-to-face.

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INTRODUCTION

Science and technology are continuously developing from year to year. The development of science and technology is not without reason. Humans are always trying to find various innovations so that every job becomes more manageable, especially in the era of the industrial revolution 4.0. [Nastiti & Abdu \(2020\)](#) stated that the development of information technology is currently reaching all areas of people's lives, including education. [Aswita \(2015\)](#) argues that education is one of the essential factors in determining the nation's progress and is a long-term investment in human resource development.

[Suripto & Subayil \(2020\)](#) also stated that the Human Development Index (HDI) affects the poverty level, so it is necessary to increase the HDI by improving the quality of human resources in the fields of education, health and supporting improvements in other fields. This means that education is one of the fields that play an essential role in improving people's welfare and solving poverty. To improve human resources, the government builds schools as places for the implementation of formal education. Schools as educational institutions have a massive role in determining the quality of the millennial generation in the future. A school is a place where students learn and get to know new things. [Arsyad \(2015\)](#) suggests that the teaching and learning process is carried out formally in schools to direct changes in students in a planned manner, both in terms of knowledge, skills, and attitudes. Instead of being a place to learn, schools are no longer used as places to learn since the coronavirus outbreak in 2019. The application of health protocols in the midst of the new normal such as social distancing and the use of masks, is a step chosen by the Indonesian government to be implemented in Indonesia.

Until now, educators and students are not allowed to carry out learning activities in schools, except for schools in the green zone. This is because the government, through the Ministry of Education, Culture, Research, and Technology, prohibits face-to-face learning. Learning must be carried out even though the Covid-19 virus has become a terrifying epidemic. Various efforts have been made to break the chain of the spread of Covid-19, one of which is online learning. [Sadikin & Hamidah \(2020\)](#) stated that online learning could reduce the spread of Covid-19.

As an effort to support government policies, there should be no need to oppose the rules set by the government. What needs to be done as educators is to innovate in learning so that learning, especially online learning, is not dull.

[Arsyad \(2015\)](#) revealed that learning media could increase and direct children's attention to learning motivation. [Sunhaji \(2014\)](#) argues that the position and role of the teacher are often considered the most responsible component in the education system. This means that the teacher is a determinant of the success of student learning. For this reason, teachers are expected to be able to design learning media that can attract students' attention.

From the results of interviews conducted with students and teachers in biology studies at GKPI Private High School Padang Bulan Medan, it was found that the classroom is the only e-learning media used by teachers in the teaching and learning process in online learning. The results of interviews conducted on students also explained that teachers minimally used PowerPoint during online learning. As a result, students feel bored when studying. Some concepts in biology require animation or digital media to make it easier for students to learn. [Wahyuni et al. \(2013\)](#) suggested that the material for the digestive system is quite tricky, so students will more easily understand the concept if the learning is equipped with media. In addition, the obstacle faced by students during online learning is the lack of internet quota they have.

The observations on biology learning at GKPI Private High School Padang Bulan Medan, it is known that teachers only use PowerPoint as a medium/messenger, so that the learning carried out is still teacher-centered, which means that learning is centered on the teacher and students tend only to listen and pay attention to the teacher when explaining learning materials. This is contrary to the main objective of the 2013 curriculum, which is that students are expected to be able to build their knowledge independently based on existing media or learning resources.

Based on the problems that arise, innovative efforts to overcome these problems need to be made. This strongly supports the development of multimedia in biology learning. [Sari et al. \(2013\)](#) suggested that learning multimedia is effectively used as a learning resource and provides better learning performance. [Arsyad \(2015\)](#) suggests that learning multimedia can be equated with learning resources if the media contains material or information to support the learning process. However, when multimedia is only in the form of software or applications, multimedia is the media or tool for delivering messages. [Supriadi \(2015\)](#) explains that learning resources are all sources such as messages, people, materials, tools, techniques, and backgrounds used by students as

sources for learning activities and can improve the quality of their learning.

Learning multimedia was developed using Macromedia Flash 8 software because [Reffiane & Bayutama \(2019\)](#) stated that if designed, Macromedia Flash 8 would provide enormous benefits, such as making it easier for students to absorb subject matter increasing students' enthusiasm and motivation in learning, providing concrete learning experiences. And foster student curiosity. In addition, in running this application, there is no need for an internet connection to save students' internet quota usage. The focus of the material on the development of this multimedia is the digestive system. Since the material on the digestive system is quite difficult for students to understand, some processes in the digestive system material are abstract (the object to be studied cannot be seen directly) and complex (consisting of interconnected parts and must be studied as a whole). [Susilawati et al. \(2015\)](#) suggested that the concept of the digestive system is very complex and complicated, which is rote so that it is difficult for students to understand.

[Priyonggo & Qosyim's \(2018\)](#) research for motion system material proves that Macromedia Flash is suitable for use as a learning medium. The research results conducted by [Harahap et al. \(2015\)](#) explained that learning multimedia based on Macromedia Flash is acceptable and suitable for use in the learning process with very good criteria and can be used by students for independent study. So, this learning multimedia based on Macromedia Flash is expected to attract the interest of students because it makes interactive learning and the material presented in it easier to understand by students. Students can use this developed learning multimedia as a source of independent learning to increase student knowledge because it can be opened anywhere and anytime via cell phone or laptop. In addition, students can also re-learn some subject matter that the subject teacher may have missed or did not have time to teach due to time constraints. [Inah et al. \(2017\)](#) argue that independent learning is a student's behavior in authentically realizing his will or desire by not depending on others. Independent learning trains students not to rely too much on teacher explanations at school. In self-study, students will try to understand the content of the lesson they read on their own. In independent learning, students can ask questions or discuss with friends, teachers, or other people if they have difficulty.

The purpose of this study was to determine the responses of material experts, media experts, teacher and student responses to learning

multimedia developed using Macromedia Flash 8 software as a source of independent learning on the food digestive system material. As well as to determine the classical learning completeness of class XI IPA students at GKPI Private High School Padang Bulan Medan after using learning multimedia developed using Macromedia Flash 8 software on digestive system materials food.

METHOD

This type of research is research and development using a 4D model. [Thiagarajan et al. \(1974\)](#) suggested that the 4D model consists of four stages: Define, Design, Develop, and Disseminate. This research was conducted at the State University of Medan, and the product feasibility test was carried out at the GKPI Padang Bulan Public High School, Medan. This research was conducted from September 2020 to February 2021.

The population in this study were lecturers of biology education at Medan State University, biology teachers at GKPI Padang Bulan Medan Private High School, and all students of class XI Science at GKPI Padang Bulan Medan Private High School, totaling 56 people. By using the Purposive Sampling technique, which is a sampling technique of data sources with specific considerations, the sample in this study is a material expert validation lecturer who understands the material of the food digestive system, a media expert validation lecturer who understands the use of IT, a subject teacher who teaches Biology in class XI IPA. Class XI IPA 1, who experienced problems in the learning process, amounted to 30 people. [Ary et al. \(2010\)](#) suggested that the sample is determined based on particular characteristics, or representatives, selected from the population in purposive sampling. [Supardi \(2016\)](#) also suggested that sampling with a purposive sampling technique was characterized by the researcher's unique characteristics or objectives. The specific objectives in question are: expert lecturers will validate the product both in terms of materials and media, biology study teachers as educators will assess the product from the aspect of quality of content and objectives, instructional quality, and technical quality, and students as product users who will assess the product of the three indicators determined include: material/content, interest, and language. In order to obtain a learning multimedia product based on Macromedia Flash 8, which is feasible to be used as an independent learning resource.

Data collection techniques in this study were observation, interviews, and questionnaires. While to see students' classical learning completeness in

learning multimedia, several questions had to be done by students. The criteria for preparing questions are adjusted to the subject matter according to indicators on the material for the human digestive system.

Observations are carried out as a preliminary study to find problems in the learning process carried out by teachers and students so that appropriate solutions can be given to overcome the problems found. Interviews were conducted to support the findings in the form of problems faced by teachers and students in the learning process so that the solutions offered were following the needs of teachers and students. The data collection technique uses a questionnaire with a Likert scale reference (Sugiyono, 2016).

The questionnaires in this study were material expert validation sheets, media expert validation sheets, teacher responses questionnaire sheets, and student responses questionnaire sheets. Data analysis in this study is qualitative data analysis and quantitative data analysis.

Qualitative data sources come from corrections and input suggestions that are filled in the questionnaire. The quantitative data analysis technique used in this research is descriptive. The data is obtained with a Likert scale that has been scored in Table 1.

Table 1. Criteria for item answers

Answer options	Score
Very Good/ Strongly Agree	5
OK/ Agree	4
Fairly Good/ Neutral	3
Less/ Disagree	2
Very Poor / Strongly Disagree	1

The scores obtained were then converted into five-scale qualitative data with reference to the formula proposed by Widoyoko (2017) in Table 2.

Table 2. Data conversion

Formula	Average score	Classification
$X > \bar{X}_i + 1,8 \times sbi$	$> 4,2$	Very good
$\bar{X}_i + 0,6 \times sbi < X \leq \bar{X}_i + 1,8 \times sbi$	$> 3,4 - 4,2$	Good
$\bar{X}_i - 0,6 \times sbi < X \leq \bar{X}_i + 0,6 \times sbi$	$> 2,6 - 3,4$	Moderate
$\bar{X}_i - 1,8 \times sbi < X \leq \bar{X}_i - 0,6 \times sbi$	$> 1,8 - 2,6$	Low
$X \leq \bar{X}_i - 1,8 \times sbi$	$\leq 1,8$	Very low

Obtaining the average range of scores provided that on the Likert scale, the ideal maximum score is 5 and the ideal minimum score is 1. Thus, the X_i and sbi calculations are obtained as follows:

$$X_i = 1/2 (5 + 1) = 3$$

$$Sbi = 1/6 (5 - 1) = 0,67$$

The analysis of the limited field test was carried out to see the completeness of student learning outcomes classically. According to Hasibuan et al. (2019), the percentage of classical completeness (PKK) of cognitive test results can be determined by the formula:

$$PKK = \frac{\sum x_i}{n_i} 100 \%$$

Aryanto (2014) stated that to complete classical learning, 85% of the total population of students in the class must complete their studies, and 85% of these students must master at least 75% of the learning objectives set.

Information:

PKK = Percentage of classical completeness

$\sum x_i$ = Jumlah siswa yang lulus

n_i = total student's number

RESULTS AND DISCUSSION

This study uses a development model adapted from a 4-D model. The stages of the research can be seen in Figure 1. At the definition stage, the process of collecting information related to the product developed is carried out. This stage consists of front-end analysis to find out the problems faced by teachers and students during learning so that it is necessary to develop learning multimedia based on Macromedia Flash 8. The results are that online learning in this school is not optimal because it only uses the classroom as an e-learning medium. After all, learning activity only provides material in the classroom and assigns students to work on questions.

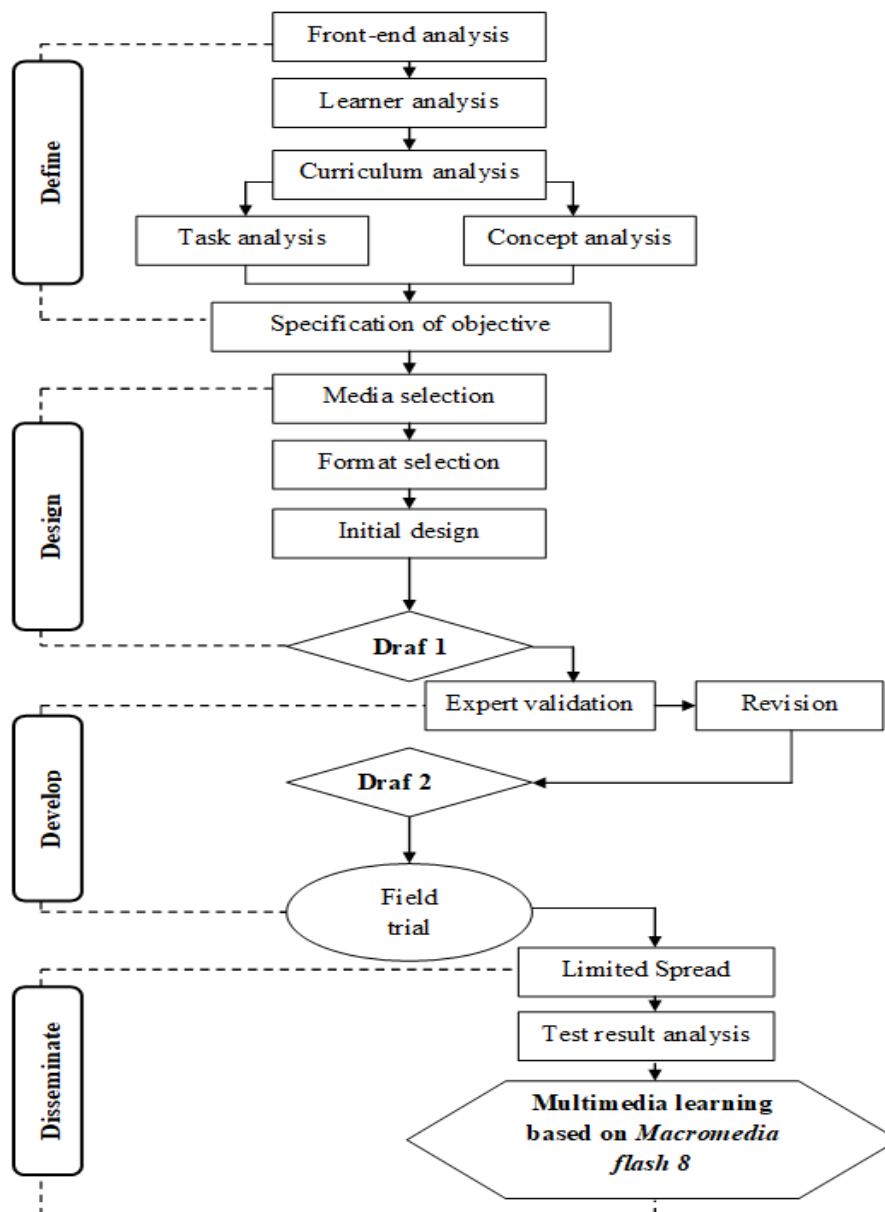


Figure 1. The Stages of The Research

From the interviews conducted, the material contained in this multimedia is digestive system material because this material is an abstract and complex material that is quite difficult for students to understand, especially when there are no animations or images as learning aids. Nevertheless, if everything (text, images, animations, videos) is combined in one application, it will make it easier for students to learn. [Wahyuni et al. \(2013\)](#) stated that biological material, especially digestive material, is a material that is quite difficult to learn. Although this material is authentic, the events cannot be seen directly, such as the digestion process of food in the abdominal cavity, so it is difficult to understand.

Based on the data obtained in student analysis, the results obtained: (1) the material for the digestive system of food in humans is one of the materials that is quite difficult, (2) students state that they are unable to remember every Biology material well after the teacher explains the material, (3) students stated that they did not know about the material of the digestive system in humans, (4) students stated that they did not know about the terms on the material of the digestive system of food in humans such as digestion and defecation, (5) students stated that they were more interested if the sentences on biological materials were simple, (6) students stated that they were proficient in using technology such as cellphones and laptops for

learning (7) students stated that they were easily bored when studying let alone just listening to lectures, (8) students included children who quickly forgot after learning certain biological materials, (9) students stated multimedia learning will help them learn the material on the digestive system of food in humans, (10) students stated and that the description of the material on multimedia needs to be considered for the breadth and depth of the material, (11) students state that independent learning with learning multimedia is an alternative in online learning, (12) students state that the presence of interactive multimedia learning is needed in learning. Based on these data, the multimedia developed is interactive multimedia that involves the active role of students and can be accessed anywhere and anytime.

Based on the curriculum analysis consisting of task analysis and concept analysis. Students must analyze relationships between organ structure, nutrition, bioprocess, and functional disturbances in the human digestive system. Other than that, students must be able to present reports on the test results of food substances contained in various types of foodstuffs, calculate the energy needs of everyone, understand food processing technology and food safety. Based on the task analysis, the materials contained in the learning multimedia based on Macromedia Flash 8 are human digestive organs, disorders of the food digestive system, nutrients, calorie need analysis, food processing technology, and food safety.

At the definition stage, namely, the formulation of learning objectives, the learning objectives for the material on the human digestive system are students must be able to name the organs included in the human digestive system, explain the function of each organ that composes the human digestive system, explain the process of digestion of food in humans. Explains various diseases and disorders related to the digestive system of food in humans, presents reports on the results of food substance tests, calculates the energy needs of everyone, and knows food processing technology and food safety.

The learning multimedia design is carried out at the design stage by referring to the teacher's PowerPoint and biology textbooks. This learning multimedia is designed based on the VISUALS principle (visible, attractive, simple, functional, accurate, legitimate, and Structured) (Miftah, 2013; Nurseto, 2011). The presentation of the material is presented with pictures and text so that learning becomes more exciting and not dull.

According to Mayer (2021), people learn better from words and pictures than just words.

This learning multimedia based on Macromedia Flash 8 is one of the innovative products in education to answer the challenges of the times, especially in the industrial era 4.0 to society 5.0. If in the era of the industrial revolution 4.0, information technology developed rapidly and colored every human life, in the era of society 5.0, Nastiti & Abdu (2020) suggested a new concept of life order that was human-centered technology-based would be formed. Indirectly, the researcher invites educators to use technology as well as possible in designing educational products that suit the needs of students so that students feel comfortable with products that have been made by teachers, especially during online learning, so that robots will not replace the role of teachers.

In designing this multimedia, the steps taken to produce draft 1 of learning multimedia based on Macromedia Flash 8 are media selection and format selection. In this study, the selected media is Macromedia Flash 8, which is installed on a laptop. The learning multimedia format chosen in this study is the tutorial format. The format was chosen based on several formats described by Kosasih (2015), including tutorial format, drill and practice format, simulation format, experimental format, and game format so that the initial design was produced (Figure 2).



Figure 2. Multimedia home view

At the development stage, the learning multimedia will be validated by experts (material experts and media experts) before the product is assessed by the teacher and tested on students. The results of the assessment of material experts and media experts can be seen in Table 3.

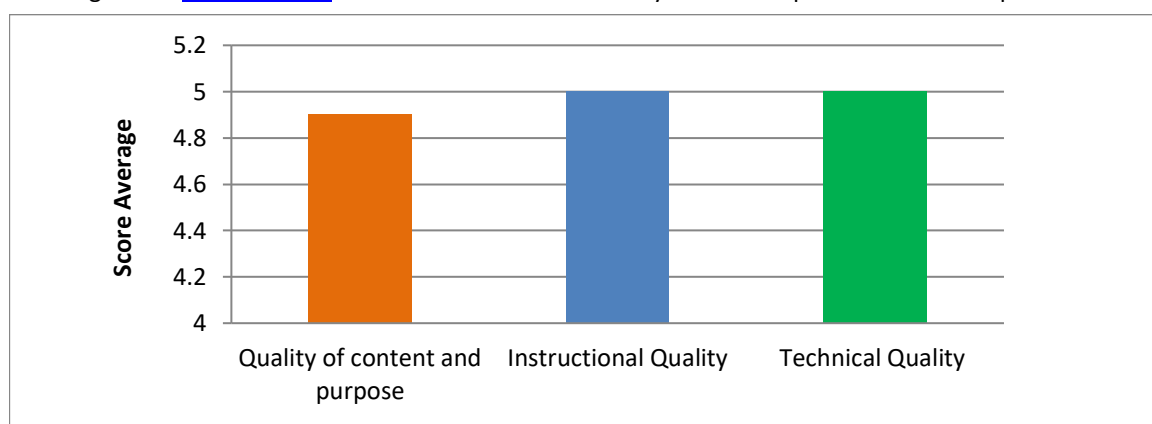
Table 3. Assessment Results of Media Experts and Material Experts

Material Expert Assessment			
Aspect	N item	Score	Category
Content Eligibility	19	88	Very good
Language Eligibility	9	39	
Average	4.5		
Media expert assessment			
Aspect	N item	Score	Category
Serving Quality	25	109	Very good
Graphic design	7	33	
Average	4.4		

The material on the learning multimedia was declared feasible because it met the eligibility criteria, which included aspects of the feasibility of content and language feasibility which were adjusted to the feasibility assessment based on Syifaunnur's research (2015) combined with the assessment instrument of the [National Education Standards Agency \(2014\)](#) with an average total score of 4.5 included in the "very good" criteria. The quality of the media in learning multimedia is declared feasible because it meets the eligibility criteria, which include aspects of presentation quality and graphic design that is adjusted to the feasibility assessment based on the criteria for evaluating media [Arsyad \(2015\)](#) combined with the

learning media evaluation instrument by [Chaeruman \(2019\)](#) with an average total score 4.4 is included in the "very good" criteria.

During the assessment of materials and media, material expert lecturers and media experts will provide comments and suggestions for improvement in learning multimedia. Product revisions are made based on comments and suggestions provided by material experts and media experts. After the product is declared feasible by material experts and media experts, the subject teacher assesses this learning multimedia (Figure 4). Teachers in the field of study respond to products based on assessments by material experts and media experts.

**Figure 3.** The results of the teacher's assessment in the field of study

The average score on the quality of content and objectives of 4.9, instructional quality of 5, and technical quality of 5 proves that the multimedia developed by the researcher is "very good" and can be used by students as a source of independent learning. Based on this, the criteria for learning resources in [Taufik \(2010\)](#), namely conformity to the characteristics of students, conformity to the subject matter, conformity to learning objectives, and the product's ability to

generate student responses, are met. Comments and suggestions from the teacher of the field of the study stated that the product developed by the researcher was very suitable for students to use, so there was no need for revision.

Products that have been assessed by the teacher of the field of study are then given to students. The overall student assessment of the product developed by the researcher can be seen in Figure 4.

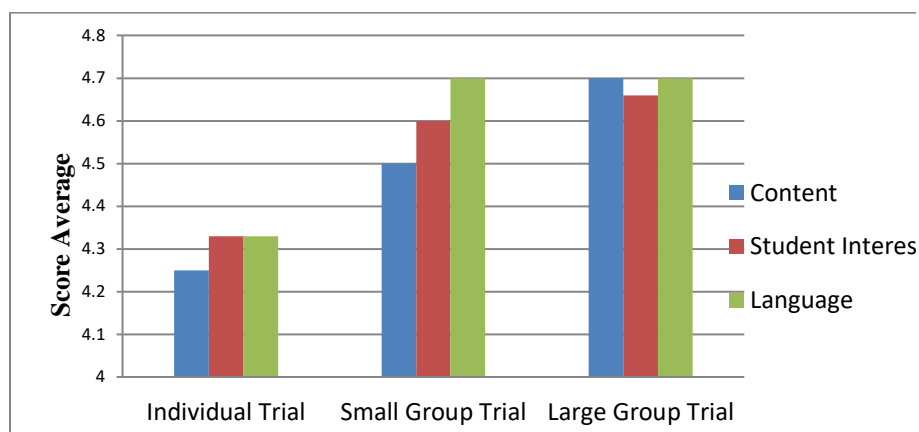


Figure 4. Results of field trials

The multimedia product developed by the researcher is in the "very good" criteria because the product's total score, especially in large group trials, is at a value of $X > 4.2$, which is 4.7. This means that this product is suitable for use as a source of student self-study. The value 4.7 explains that the product developed by the researcher is designed according to the needs of students.

At the Disseminate stage, the product was distributed to 30 students of class XI IPA at GKPI Private High School Padang Bulan Medan. As supporting data that shows student learning success and achievement of learning objectives after using learning multimedia based on Macromedia Flash 8, it can be seen from the percentage of students who achieve a minimum completeness score (Figure 5), which is 97%, with an average value of 92.5.

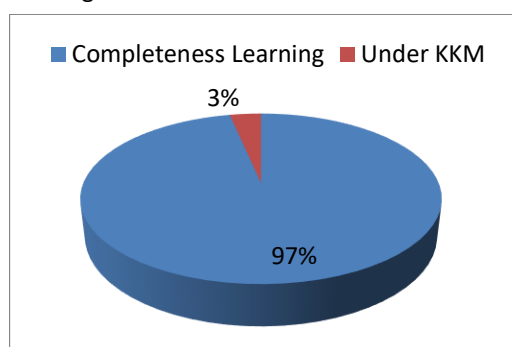


Figure 5. Percentage Of Students Score

The product developed by the researcher was declared successful in helping students learn, especially in the online period, because the percentage of classical completeness proposed by [Hasibuan et al. \(2019\)](#) and [Daryanto \(2014\)](#) of 85% were met. With the percentage of students who achieve a minimum mastery score and the average value obtained by students, this product can be declared eligible as a source of student self-study

because the criteria for learning resources in [Taufik \(2010\)](#), namely the use of learning resources for students in achieving learning objectives are met. The presence of this product has had a good influence on student learning because learning becomes more exciting and less boring and allows students to improve their memory of the lesson content.

Development research conducted by [Harahap et al. \(2015\)](#) proves that the teaching media developed by researchers can be used for student self-study with the criteria of "very good". Theoretically, the results of this study are expected to be a reference or input for other researchers, both related to further research that is developing and similar research that is broadening and intensive to be developed. With this research, it is hoped that the role of teachers in the era of society 5.0 will not be replaced. If the teacher continues to show the advantages and usefulness of his role in learning, the robot's role will never replace the position of the teacher.

The developed learning multimedia product is also expected to help the student learning process, whether with an online system or face-to-face learning. With the presence of this product as a source of independent learning, students are expected to be able to become independent, responsible, skilled students, able to solve problems, make their own decisions in determining how to learn, think creatively, critically, foster strong self-confidence, and be able to become teachers for himself.

CONCLUSION

Based on the results of the research and discussion that have been described, the conclusions in this study are as follows: Multimedia Learning based on Macromedia Flash 8 has met the eligibility criteria with an average score of 4.5, which is included in the "Very Good"

criteria based on the assessment of material experts, the score an average of 4.4 which is included in the "Very Good" criteria based on the assessment of media experts, an average score of 4.9 which is included in the "Very Good" criteria based on the teacher's response to the field of study and is included in the "Very Good" criteria with a score of an average of 4.7 based on student responses. The classical learning completeness of the students of class XI IPA Private High School GKPI Padang Bulan Medan after using Learning Multimedia as a source of independent learning got a percentage of 97%. As a suggestion to get maximum results in this study, it is necessary to conduct further product trials with a larger sample size and broader scale. In further research, it is better to test the product's effectiveness with a pretest-posttest experimental design to obtain better results.

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REFERENCES

- Arsyad, A. (2015). *Media Pembelajaran*. Jakarta: Rajawali Press.
- Ary, D., Jacobs, L.C., & Sorensen, C. (2010). *Introduction to Research in Education*. USA: Wadsworth, Cengage Learning.
- Aswita, D. (2015). Identifikasi Masalah yang Dihadapi Guru Biologi dalam Pelaksanaan Pembelajaran Pada Materi Ekosistem. *Jurnal Biotik*, 3(1), 63-68.
- Badan Standar Nasional Pendidikan. (2014). *Instrumen Penilaian Buku Teks Pelajaran Biologi Sekolah Menengah Atas/Madrasah Aliyah*. Diakses 10 Oktober 2020 dari <http://bsnp-indonesia.org/?p=1340>
- Chaeruman, U.A. (2019). *Instrumen Evaluasi Media Pembelajaran*. Diakses 09 Oktober 2020 dari <https://www.researchgate.net/publication/338208296>
- Daryanto. (2014). *Penelitian Tindakan Kelas dan Penelitian Tindakan Sekolah*. Yogyakarta: Gava Media.
- Harahap, H.S., Hasruddin, & Djulia, E. (2015). Pengembangan Media Ajar Interaktif Biologi Berbasis Macromedia Flash Pada Materi Sistem Pencernaan Makanan Manusia Untuk Kelas XI SMA/MA. *Seminar Nasional XII Pendidikan Biologi FKIP UNS*. Surakarta: Program Studi Pendidikan Biologi, Universitas Sebelas Maret.
- Hasibuan, A.M., Saragih, S., & Amry, Z. (2019). Development Of Learning Materials Based on Realistic Mathematics Education to Improve Problem Solving Ability And Student Learning Independence. *International Electronic Journal of Mathematics Education*, 14(1), 243-252. <https://doi.org/10.29333/iejme/4000>
- Inah, E.N., Ghazali, M., & Santoso, E. (2017). Hubungan Belajar Mandiri Dengan Prestasi Belajar PAI di MTsN 1 Konawe Selatan. *Jurnal Al-Ta'dib*, 10(2), 19-36.
- Kosasih, I. (2015). Pengembangan Pembelajaran Berbasis Multimedia Interaktif Dalam Meningkatkan Kualitas Pembelajaran. *Saintifika Islamic: Jurnal Kajian Keislaman*, 2(1).
- Mayer, R.E. (2021). *The Cambridge Handbook Of Multimedia Learning*. New York: Cambridge University Press.
- Miftah, M. (2013). Fungsi dan Peran Media Pembelajaran Sebagai Upaya Peningkatan Kemampuan Belajar Siswa. *Kwangsan: Jurnal Teknologi Pendidikan*, 1(2), 95-105. <https://doi.org/10.31800/jtp.kw.v1n2.p95--105>
- Nastiti, F.E. & Abdu, A.R.N. (2020). Kesiapan Pendidikan Indonesia Menghadapi Era Society 5.0. *Edcomtech*, 5(1), 61-66.
- Nurseto, T. (2011). Membuat Media Pembelajaran Yang Menarik. *Jurnal Ekonomi dan pendidikan*, 8(1), 19-35.
- Priyonggo, F.V. & Qosyim, A. (2018). Pengembangan Media Pembelajaran Interaktif Berbasis Macromedia Flash Untuk Materi Sistem Gerak Pada Manusia Kelas VII. *PenSa E-Jurnal: Pendidikan Sains*, 6(2). Diakses dari <https://jurnalmahasiswa.unesa.ac.id/index.php/pennsa/index>.
- Reffiane, F. & Bayutama, L. (2019). Interactive Media Development Based Macromedia Flash 8 on Themeliving Matter of Primary Class IV. *International Journal of Active Learning*, 4(1), 18-23.
- Sadikin, A. & Hamidah, A. (2020). Pembelajaran Daring di tengah wabah Covid-19. *Jurnal Ilmiah Pendidikan Biologi*, 6(2), 214-224.

- Sari, I.N., Saputri, S., & Ashadi. (2013). Pengembangan Multimedia Pembelajaran Berbasis Macromedia Flash Sebagai Sumber Belajar Mandiri Pada Materi Koloid Kelas XI IPA SMA dan MA. *Jurnal Pendidikan Kimia*, 2(3), 152-157.
- Sugiyono. (2016). *Metode Penelitian Pendidikan: Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.
- Sunhaji. (2014). Konsep Manajemen Kelas dan Implikasinya Dalam Pembelajaran. *Jurnal Kependidikan*, 2(2), 30-46.
- Supardi. (2016). Populasi dan Sampel Penelitian. *Jurnal Ilmu-ilmu Sosial*. <https://10.20885/unisia.v0i17.5325>
- Supriadi. (2015). Pemanfaatan Sumber Belajar Dalam Proses Pembelajaran. *Lantanida Journal*, 3(2), 127-139.
- Suripto & Subayil, L. (2020). Pengaruh Tingkat Pendidikan, Pengangguran, Pertumbuhan, Ekonomi, dan Indeks Pembangunan Manusia Terhadap Kemiskinan di D.I. Yogyakarta periode 2010-2017. *Jurnal Ilmiah Ekonomi Pembangunan*, 1(2), 127-143.
- Susilawati, Jumrodah, & Handayani, T.M. (2015) Perbandingan Penggunaan Multimedia Interaktif Adopsi dengan Multimedia Interaktif MTSN Pada Konsep Sistem Pencernaan di MTSN 1 Model Palangka Raya. *Edusains*, 3(1), 37-51.
- Taufik. (2010). *Strategi Belajar Mengajar*. Jakarta: Inti Prima.
- Thiagarajan, S., Semmel, D.S., & Semmel, M.I. (1974). *Instructional Development For Training Teacher Of Exceptional Children*. Bloomington Indiana: Indiana University.
- Wahyuni, S.E., Sudarisman, S., & Karyanto, P. (2013). Pembelajaran Biologi Model POE (Prediction, Observation, Explanation) Melalui Laboratorium Rill dan Laboratorium Virtual Ditinjau Dari Aktivitas Belajar dan Kemampuan Berpikir Abstrak, 2(3), 269-278.
- Widoyoko, E.P. (2017). *Evaluasi Program Pembelajaran*. Yogyakarta: Pustaka Pelajar.