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# Effectiveness of microlearning model on the learning outcomes of elementary school students

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**Abstract**

This study aimed to evaluate the effectiveness of the Microlearning model on student learning outcomes. The study involved students from class VC (n = 24) and class VB (n = 23). A randomized posttest-only control group design experimental approach was used, with data collected through multiple-choice tests created by the class teacher. The research data were analyzed using descriptive and inferential statistics, specifically the student t-test with a significance level of 0.05. The findings revealed a significant difference in learning outcomes between the class using the microlearning model and the class employing a conventional model. These results suggest that the microlearning model significantly enhances student learning outcomes, demonstrating its effectiveness as a teaching strategy. The study highlights the potential of microlearning in improving educational practices and provides valuable insights for educators seeking to optimize student engagement and achievement.

***Keywords:*** Elementary school; learning outcomes; microlearning model; students

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## 1. INTRODUCTION

Effective learning is inherently linked to engaging teaching strategies, which are primarily driven by teachers who are creative and innovative in their approach to instructional delivery (Ohlsson et al., 2024). Teachers play a crucial role in cultivating enthusiasm for learning and achieving learning objectives, actively creating engaging learning environments that foster student motivation (Cilalı et al., 2024). In addition to the teacher's teaching methods, the use of appropriate teaching materials and the learning environment are essential elements in creating an effective and engaging learning experience (Cilalı et al., 2024). These factors significantly impact the continuity and success of the learning process between teachers and students.

The continuous advancement of information and communication technologies has led to significant transformations in educational settings. Traditional face-to-face interactions are increasingly being replaced by online learning, and conventional teaching resources, such as whiteboards and printed materials, are being substituted with a wide array of digital tools accessible through various electronic platforms. As a result, teachers must not only possess a deep understanding of educational theory and its applications but also have the technical skills necessary to effectively utilize online learning tools and environments in their teaching (Al-Shehri, 2021; Donovan et al., 2022).

Learning is a dynamic process wherein the teacher facilitates students in reaching their learning objectives. The concept of learning varies as individuals approach it from different perspectives. Good learning is characterized by creativity, innovation, and productivity. According to Ni Putu et al. (2019), creative, innovative, and productive learning provides an environment in which students are encouraged to generate unique ideas through their cognitive processes, using these ideas to produce valuable and practical outcomes.

Learning resources are essential components of the educational process, including messages, people, materials, tools, technologies, and environments that are systematically designed to enhance the quality of learning (Surahman et al., 2020). Textbooks, for example, are a crucial part of the learning ecosystem, serving as resources intended for specific educational levels and subjects. They are designed to support particular learning programs and are integral to achieving instructional goals (Surahman et al., 2020).

The use of instructional materials plays a significant role in the learning process, as they help foster independence and creativity in students. These materials empower students to take responsibility for their learning, reducing their reliance on teachers. However, at SDN 106813 Amplas, the teaching materials currently in use are outdated and fail to align with the evolving needs of students. There is a clear need for the introduction of innovative and engaging educational materials that reflect current trends and meet the demands of modern learning environments.

The COVID-19 pandemic has drastically reshaped the education system, forcing a shift to online learning and altering traditional teaching methods. Observations at SDN 106813 Amplas indicate that the school does not yet have access to digital learning materials. To address this gap, researchers have developed innovative teaching materials to make the learning process more engaging and less monotonous. The goal of this development is to create materials that inject positive energy into primary education while adapting to the unique circumstances presented by the pandemic.

Media plays a vital role in the learning process by helping teachers convey lessons through audio-visual tools that stimulate student engagement (Adhipertama et al., 2020). Technology has proven to be a key enabler of learning during the pandemic, particularly in supporting independent student learning. The appropriate use of engaging teaching models can significantly enhance students' enthusiasm and motivation to learn. One such model, microlearning, is especially suited to this situation. Microlearning focuses on delivering small, easily digestible learning segments that are highly effective for long-term retention. It aims to develop specific knowledge, skills, and attitudes according to the needs of learners in a particular domain (Al-Shehri, 2021). As a

widely adopted strategy in language acquisition, microlearning has revolutionized learning patterns in the digital age (Surahman et al., 2020).

Microlearning is characterized by short-duration learning activities centered on specific objectives, focusing on measurable outcomes. Ghasia and Rutatola (2021) highlight seven attributes of microlearning, including time, content size, curriculum type, modularity, and the compatibility of content with various media formats, such as computers and mobile devices. The short duration of micro-units makes them ideal for integration with different media platforms.

Given the positive impact of digital learning modules on student engagement and learning outcomes, the researchers are particularly interested in exploring the effectiveness of the Microlearning Model at SDN 106813 Amplas. The research seeks to examine how the application of this model influences student learning and educational outcomes in higher-grade levels of the school.

### 1.1. Theoretical review

#### *1.1.1. Digital module*

According to Setiyadi and Ismail (2017), a module is a set of learning tools that have been systematically organized and designed to aid students in the learning process, helping them achieve their educational goals. To understand e-Modul media, it is essential to first grasp the definitions of both media and e-Modules. E-Modul refers to a set of digital or non-printed teaching materials that are methodically arranged to facilitate independent learning, encouraging students to solve problems on their own (Fausih & Danang, 2015). Fausih and Danang (2015) identified several key characteristics of an effective module, including:

a. Self-instructional: The module allows students to learn independently without needing external assistance.

b. Self-contained: All learning materials required for a particular unit of study are included within one complete module.

c. Stand-alone: The module can be used independently and does not require supplementary media or resources to be effective.

d. Adaptive: The module should be flexible and capable of adapting to advancements in science and technology while aligning with the specific needs of students.

e. User-friendly: The module should be easy to navigate and meet user-friendly standards, ensuring it is accessible for learners.

f. Consistency: The module maintains consistency in its design, including aspects such as font usage, spacing, and layout, to provide a cohesive and professional learning experience.

#### *1.1.2. Powerpoint interaction*

PowerPoint is a computer program for presentations developed by Microsoft in Office application packages, Microsoft Office, in addition to Microsoft Word, Excel, Access, and several other programs (Srimaya, 2017). With this PowerPoint, learning materials usually have written descriptions that are easy to read by students, the presence of pictures can attract students' attention, and evaluations can be made interactively at the end of the learning materials, making it easier for students to improve their skills (Prasetyo et al., 2021).

#### *1.1.3. Infographics*

In the findings in the field, the majority of the audience is more interested in content that presents more visual forms of a material concept. Infographics are material concepts that are outlined in the form of a complete, concise, and clear information display straight to the point in the form of a graphic display and added with

interesting pictures that match the content so that students more easily understand the material presented at each stage (Prasetyo et al., 2021).

#### *1.1.4. Graphic animation*

Animation is a collection of images that are processed in such a way as to create the illusion of movement. Animation displays or displays a series of images that change gradually (progressively) at high speed. Animation is used to give moving images of fixed or static objects that appear to be moving and alive.

The use of learning media in the form of graphic animation is one form of multimedia because it uses part of the senses to understand concepts. Multimedia can be defined as using multiple media. Multimedia can be interpreted as the use of several different media to combine and convey information in the form of text, which is the easiest and most effective form of conveying messages or information, audio, which is the form of objects that are captured by the auditory system, and graphics, namely the form of images used to convey messages. , video, which is a form of object that is captured by a visual system, hybrid, which is a mixture or combination of multimedia objects such as audio and video, and animation, which is a collection of images that are processed in such a way that movement appears (Purwati, 2010).

#### *1.1.5. Podcasts*

Podcasts are audio or video files that are uploaded to the internet, allowing users to access them regardless of whether they are subscribed, and they can be listened to or viewed using a computer or portable digital media player (Zellatifanny, 2020). Zellatifanny (2020) highlights several advantages of podcasting over traditional communication media, including: 1) the flexibility it offers listeners, enabling them to access recordings at their convenience, regardless of time and location; 2) the relatively low cost of podcast production, which makes it affordable and allows most podcasts to be accessed for free by subscribers; 3) the global availability of podcasts, as they are digital and accessible online to anyone with internet access; and 4) their user-friendly nature, as numerous podcast aggregators like iTunes facilitate the discovery, downloading, and listening of the latest podcasts on devices such as MP3 players, iPods, or computers.

#### *1.1.6. Explainer videos*

An explainer video by Rahmadianto & Andito (2018), is a video that facilitates an institution/company to grow and build the power of consumers' basic perceptions of a brand/product or service. This video explains who or what promotes a business at a time. This is a great way to attract existing customers, as well as new ones. Currently, the amount of time someone spends on YouTube every month is more than 6 billion hours. This shows that video is very important as a medium of communication.

The expected goal of applying this microlearning model is the achievement of learning objectives or student learning outcomes. The learning outcomes are behavior changes obtained by students after experiencing learning activities (Rifa'I & Anni 2009). Changes in behavior as a result of learning activities include changes in cognitive, attitude, and psychomotor (Suprijono, 2009). Learning outcomes are abilities that exist in individuals after receiving learning experiences (Sudjana, 2011). The learning outcomes possessed by students are not obtained suddenly but through a process of activities carried out by the students themselves. The abilities possessed by students as a result of learning in schools require a curriculum, learning methods, learning media, and student-centered assessment (Akinmola, 2014; Hank & Huber, 2024). A student's learning outcomes are influenced by two factors, namely internal factors and external factors (Daryanto, 2009). The learning model is one of the external factors that are certainly related to internal factors, especially related to a person's psychological factors in learning, such as the microlearning model, which makes children motivated to learn. So, learning activities or learning experiences that children get by using microlearning learning models through student applications can

open interactive power points, infographics, graphic animations, podcasts, and explainer videos for students to be easier to understand, remember, and understand (Yuhana et al., 2024).

### 1.2. Purpose of study

This study aimed to evaluate the effectiveness of the Microlearning model on student learning outcomes by examining its impact on academic performance and engagement. It involved delivering content in small, focused segments to determine whether this approach improves student understanding, retention, and participation compared to traditional methods. The research assessed these outcomes through tests, surveys, and feedback to gauge the model's impact on both learning results and student motivation.

## 2. RESEARCH METHODS

### 2.1. Research design

This study utilized a Randomized Posttest-Only Control Group Design. The design was aimed at evaluating the effectiveness of the Microlearning model compared to traditional learning methods on student learning outcomes. The experimental group received instruction using the Microlearning model, while the control group was taught using conventional methods. After the learning process, a post-test was administered to both groups to assess their learning outcomes.

### 2.2. Participants

The participants were fifth-grade students from SDN 106813 Amplas during the 2022/2023 academic year. A total of 47 students participated, with 24 students in class VC (experimental group) and 23 students in class VB (control group). These students were randomly assigned to their respective groups. The experimental group received treatment through the application of the Microlearning model, while the control group was taught through traditional methods.

### 2.3. Data collection instruments

The primary data collection instrument used in this study was a multiple-choice test designed by the class teacher. The test was based on Sub-theme 1: "Organs and Animal Movement," which was the focus of the learning sessions. The test was administered to both the experimental and control groups at the end of the six-day instructional period. The test items were developed to measure the students' understanding and learning outcomes related to the topic.

### 2.4. Data analysis

**The data collected from the** post-test **were analyzed using both descriptive and inferential statistics. Descriptive statistics were used to summarize and describe the overall performance of the students in both groups. Inferential statistics, specifically an independent samples t-test, were conducted to compare the learning outcomes between the experimental and control groups. The t-test was performed with a significance level of t(1) = 0.05, with degrees of freedom calculated as n1 + n2 - 2, to determine if there was a statistically significant difference in the learning outcomes between the two groups.**

## 3. RESULTS

### 3.1. Description of research results

Based on the research data obtained about student learning outcomes between the experimental class and the control class, Table 01 presents the results of data analysis descriptively to describe student learning outcomes as follows.

**Table 1**

*Summary of the results of descriptive analysis of research data*

| No. | Statistical description | VC class (E) | Class VB (K) |
|---|---|---|---|
| 1 | Subject (n) | 24 | 23 |
| 2 | Lowest value | 70 | 60 |
| 3 | The highest score | 95 | 85 |
| 4 | Average | 85 | 72.39 |
| 5 | Total score | 2040 | 1665 |

Table 1 above shows that the score acquisition of students who use the microlearning model device, namely the VC class as the experimental group, is, on average, 85 higher than the 72.39 grades obtained by the VB class students who are taught using the conventional model. This is indicated by the highest score in the experimental class, 95, and the lowest score, 70, while the highest score was 85 for the control class and the lowest score was 60.

In more detail, the distribution of student scores for the two research groups can be seen in Table 2.

**Table 2**

*Distribution of students' scores in the experimental class and the control class*

| Experiment Class (M. Microlearning) | | | Control Class (M. Conventional) | | |
|---|---|---|---|---|---|
| Test scores | F | % | Test scores | f | % |
| 70 | 1 | 4.17 | 60 | 1 | 4.34 |
| 75 | 2 | 8.33 | 65 | 5 | 21.74 |
| 80 | 3 | 12.5 | 70 | 5 | 21.74 |
| 85 | 11 | 45.83 | 75 | 8 | 34.78 |
| 90 | 4 | 16.67 | 80 | 2 | 8.70 |
| 95 | 3 | 12.5 | 85 | 2 | 8.70 |
| Total | 24 | 100 | | 23 | 100 |

From Table 2, the distribution of scores for classes using the microlearning model that obtained a score of 70 was 1 person (4.17%), a score of 75 was 2 people (8.33), a score of 80 was 3 people (12.5%), a score of 80 was 3 people (12.5%). 85, as many as 11 people (45.83%), the value of 90 as many as 4 people (16.67%), and the value of 95 as many as 3 people (12.5%). While the value for the class that uses conventional learning models that get the highest score of 85 is 2 people (8.70%), the value of 80 is 2 people (8.70%), the value of 75 is 8 people (34.78%), then followed by the value of 70 and 65 each was 5 people (21.74%), and there was still 1 person with a score of 60 (4.34%).

Furthermore, to determine the level of tendency of student learning outcomes, both in the experimental class using the microlearning model and the control class using the conventional model can be seen in Table 3.

**Table 3**

*The trend of student learning outcomes in the experimental class and control class*

| **Score** | **Microlearning Model (E)** | | **Conventional Model (K)** | | **Interpretation** |
|---|---|---|---|---|---|
| | **F abs** | **F rail (%)** | **F abs** | **F rail (%)** | |
| 0-60 | 0 | 0.00 | 1 | 4.35 | Not enough |
| 61-75 | 3 | 12.50 | 18 | 78.26 | Enough |
| 76-85 | 14 | 58.33 | 4 | 17.39 | Well |
| 86-100 | 7 | 29.17 | 0 | 0.00 | Very good |

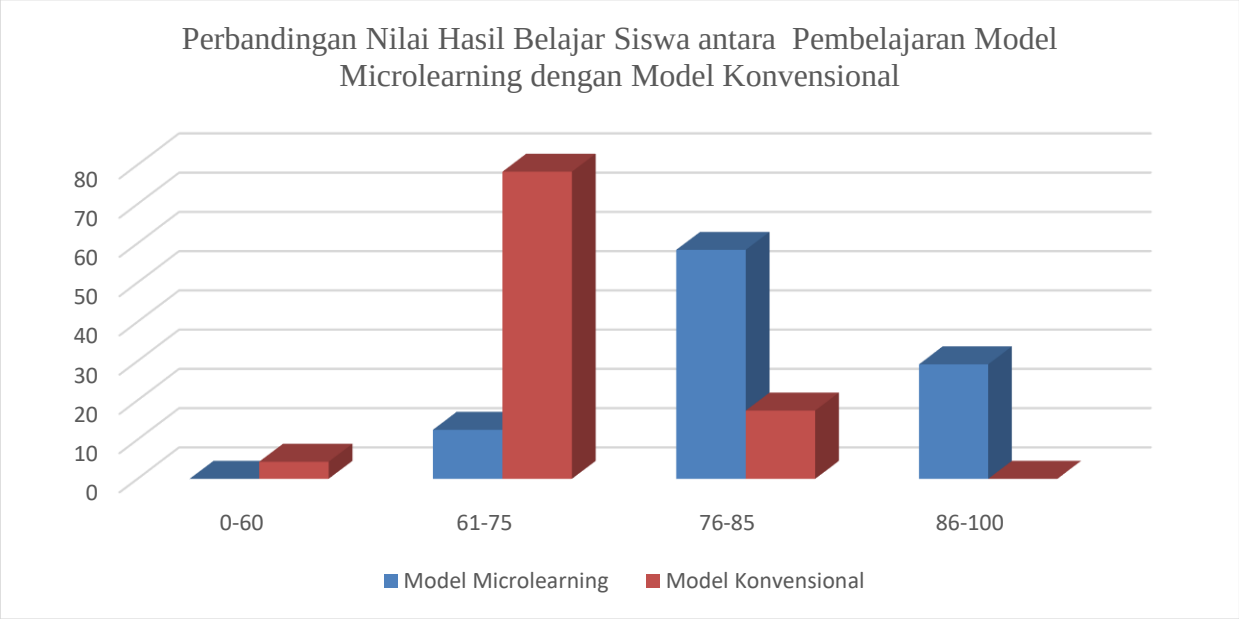
| | | | | |
|---|---|---|---|---|
| Total | 24 | 100 | 23 | 100 |

Table 03 above shows that the learning outcomes taught using the microlearning model tend to be in the good category (58.33%) followed by very good (27.17%) and students who get an adequate score are only 12.50%, while the learning outcomes in class those taught using the conventional model tend to be in the sufficient category (78.26) even in the less category there are still 4.35%) while students who score in the good category are only 17.39%. Based on the results of the descriptive data analysis, it can be seen that the average student learning outcomes taught using the microlearning model are much better than the average student learning outcomes taught using the conventional model.

The comparison of student learning outcomes from the two classes can be seen in Figure 1 below.

**Figure 1**

*Comparison of student learning outcomes between microlearning and conventional models*




### 3.2. Hypothesis test

Ho : 0 = 1; the average learning outcomes of students who are taught with the microlearning model are the same as the learning outcomes of students who are taught using the conventional model

Ha : 0 > 1: The average student learning outcomes taught using the microlearning model are greater than the student learning outcomes taught using the conventional model

Based on the results of statistical calculations using the student t-test, the value of thit = 6.754 while the price of ttab 1- (0.05), dk = 24 + 23 – 2 (45) = 2.014. This shows that thit > tab (6.754 > 2.014). So, Ho is rejected, or Ha is accepted, and the test gives significant results at the 5% level. This means that the average learning outcomes of students who are taught with the microlearning model are greater than the learning outcomes of students who are taught using conventional learning models. Thus, it can be concluded that the application of the microlearning model has a high effectiveness on student learning outcomes.

## 4. DISCUSSION

The result of the study has shown that the application of the microlearning model significantly affects student learning outcomes compared to learning outcomes that apply conventional learning that does not apply the microlearning model. This is evident from the average learning outcomes of students who use the microlearning model, which is 85, higher than the average learning outcomes of students who do not use the microlearning model or conventional learning model, which is 72.39. It can be accepted that the application of the microlearning model in learning makes students have high enthusiasm and motivation to gain more knowledge related to the themes or sub-themes being studied. In the microlearning model, the content of the organs and movements of the animals being taught is made in such a way in the form of interactive PowerPoint presentations, learning videos, flashcards, podcasts, and graphic animations.

**Through the use of the microlearning model**, **students can store information effectively in long-term memory**, **and** this **can be put to good use when testing is done to measure the achievement of learning outcomes about the sub-themes of animal organs and movements. The results of this study are in line with the statement of Singh (2014)**, **which states that the use of the microlearning model makes students focus on individual learning needs**. Besides **that**, **learning activities are short and can be done with loose time and flexible learning places. Likewise, the supports the research results of Mohammed et al. (2008)**, **who concluded that learning with the microlearning method can improve students' learning abilities by up to 18% compared to traditional methods in ICT lessons. Recent studies have shown that short content can increase information retention by 20%, whereas by using conventional methods**, **the knowledge acquired by students is easily forgotten (Hug & Frensen**, **2007), and the average attention of students in learning decreases (Renard, 2017). In the microlearning model, knowledge placement is made in small fractions so that it is easily understood by students (Mohammed et al. 2018).** Referring to the results of this study which shows that the microlearning model is more effective in improving student learning outcomes compared to conventional learning methods, in the future it will try to develop these microlearning devices on other themes and sub-themes in grade 5 so that they can help and facilitate students to acquire knowledge that can be stored in long-term memory and assist teachers in achieving learning objectives as planned.

## 5. CONCLUSION

Based on the results of the research and discussion of the research results above, it can be concluded that the application of the microlearning model has a high effectiveness on student learning outcomes in high school grades. The learning outcomes of students who apply the microlearning learning model are much higher, with an average score of 85 being in a good category compared to the learning outcomes of students who are taught without using the microlearning learning model or conventional learning model, where the average student score of 72.39 is in the sufficient category. The application of the use of the microlearning learning model allows students to focus their attention well on the subject matter contained in the microlearning device, and makes students motivated to learn without having to be limited by time, place, or the presence of the teacher in class, and makes it easier for students to understand, master, and store the material learned in their memory.

The application of the microlearning model can be used in higher classes and on other learning themes, making it easier for students to master learning materials and making it easier for teachers to achieve learning goals as expected. In connection with the results of this study, it is necessary to develop a microlearning model for learning themes as a whole, making it easier for students to understand and master the subject matter. Other learning themes make it easier for students to master the learning material and make it easier for teachers to achieve learning objectives as expected. In connection with the results of this study, it is necessary to develop a microlearning model for learning themes as a whole, making it easier for students to understand and master the subject matter. Other learning themes make it easier for students to master the learning material and make it easier for teachers to achieve learning objectives as expected. In connection with the results of this study, it is

necessary to develop a microlearning model for learning themes as a whole, making it easier for students to understand and master the subject matter.

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## REFERENCES

Adhipertama, I. M. C., Jampel, I. N., & Sudatha, I. G. W. (2020). The Development of Learning Video Based on Micro-Learning Principle Towards Science Subject in Junior High School. *Indonesian Journal Of Educational Research and Review*, *3*(3), 132-143. https://ejournal.undiksha.ac.id/index.php/IJERR/article/view/30761

Akinmola, E. A. (2014). Developing mathematical problem-solving ability: a panacea for sustainable development in the 21st century. *International Journal of Education and Research*, *2*(2), 1-8. http://ijern.com/journal/February-2014/28.pdf

Alshehri, A. (2021). The effectiveness of a micro-learning strategy in developing the skills of using augmented reality applications among science teachers in Jeddah. *International Journal of Educational Research Review*, *6*(2), 176-183. https://dergipark.org.tr/en/pub/ijere/article/869642

Cilalı, B., Michou, A., & Daumiller, M. (2024). Pathways to Need-Supportive Teaching: Teaching Mindsets and Motivation to Teach. *The Asia-Pacific Education Researcher*, 1-11. https://link.springer.com/article/10.1007/s40299-024-00885-8

Cilalı, B., Michou, A., & Daumiller, M. (2024). Pathways to Need-Supportive Teaching: Teaching Mindsets and Motivation to Teach. *The Asia-Pacific Education Researcher*, 1-11. https://link.springer.com/article/10.1007/s40299-024-00885-8

Daryanto, P. (2009). *Active Learning*. Jakarta: PT. Index.

Donovan, S. L., Odegard, T. N., Farris, E. A., & Flipse, J. L. (2022). Testing the impact of online training in areas of reading instruction on educator knowledge. *Reading and Writing*, *35*(1), 199-221. https://link.springer.com/article/10.1007/s11145-021-10179-w

Fausih, M., & Danang, T. (2015). Pengembangan media e-modul mata pelajaran produktif pokok bahasan "instalasi jaringan lan (local area network)" untuk siswa kelas xi jurusan teknik komputer jaringan di smk nengeri 1 labang bangkalan madura. *Jurnal Unesa*, *1*(01), 1-9. https://ejournal.unesa.ac.id/index.php/jmtp/article/view/10375

Ghasia, M. A., & Rutatola, E. P. (2021). Contextualizing micro-learning deployment: An evaluation report of platforms for the higher education institutions in Tanzania. *International Journal of Education and Development using Information and Communication Technology*, *17*(1), 65-81. https://eric.ed.gov/?id=EJ1285500

Hank, C., & Huber, C. (2024). Do peers influence the development of individuals' social skills? The potential of cooperative learning and social learning in elementary schools. *International Journal of Applied Positive Psychology*, *9*(2), 747-773. https://link.springer.com/article/10.1007/s41042-024-00151-8

Hug, T., & Friesen, N. (2007). Outline of a microlearning agenda. *Didactics of microlearning. Concepts, discourses and examples*, 15-31. https://books.google.com/books?hl=en&lr=&id=J0-KAwAAQBAJ&oi=fnd&pg=PA15&dq=Hug,+T.,+%26+Friesen,+N.+(2007).+Outline+of+a+microlearning+agenda.+Didactics+of+Microlearning.+Concepts,+Discourses+and+Examples,+15-31.&ots=3vK-whAHnw&sig=G4t2R1DvOx8uJ9Qk5ZurAcKnDVE

Simaremare, A., Wau, Y., Hutagalung, T., Hutagalung, H.P., Annissa, D. & Pratama, C.Y. (2025). Effectiveness of microlearning model on the learning outcomes of elementary school students. *Contemporary Educational Research Journal*, *15*(1), 23-32. https://doi.org/10.18844/cerj.v15i1.9628

Mohammed, G. S., Wakil, K., & Nawroly, S. S. (2018). The effectiveness of microlearning to improve students' learning ability. *International Journal of Educational Research Review*, *3*(3), 32-38. https://dergipark.org.tr/tr/doi/10.24331/ijere.415824

Ni Putu, D. A., I Gde, W. S., & I Made T. (2019). Development of Microlearning-Based Learning Animation in Class III Mutiara Singaraja Elementary School in the 2018/2019 Academic Year. *Journal of Ganesha University of Education EDUTECH, 7*(1), 23–32.

Ohlsson, A., Gericke, N., & Borg, F. (2024). Implementing education for sustainability in preschool: Teaching strategies and learning environments. *Journal of Outdoor and Environmental Education*, 1-23. https://link.springer.com/article/10.1007/s42322-024-00181-5

Prasetyo, A. R., Rahmawati, N., Ulfa, S., Widodo, T., Qomar, M., & Wulansari, A. E. (2021). The Development of a Virtual Module Based on the Infographic Dynamics of Art Materials. *KnE Social Sciences*, 178-185. https://knepublishing.com/index.php/KnE-Social/article/view/9193

Purwati, H. (2010). The Effectiveness of Mathematics Learning Based on the Application of Tgt Assisted by Graphic Animation in Class Iv. Axiom. *Journal of Mathematics and Mathematics Education UPGRIS Semarang, 1*(2).

Rahmadianto, S. A., & Andito, T. (2018). Ma Chung University Video Explainer Design as Promotional Media Innovation. 2(2), 61–68.

Renard, L. (2017). *Microlearning, a new way of teaching without losing attention*.

Rifa'i, R. A., & Anni, C. (2009). Educational Psychology. Semarang: Semarang State University.

Setiyadi, M. W., & Ismail, H. A. G. (2017). Development of Biology Learning Module Based on Scientific Approach To Improve Student Learning Outcomes. *Journal of Educational Science and Technology (EST)*, *3*(2), 104.

Singh, R. P. (2014). 17 Awesome resources on micro-learning, available at: https://elearningindustry.com/awesome-resources-on-micro-learning

Srimaya. (2017). The Effectiveness of Power-point Learning Media to Improve Students' Motivation and Biology Learning Outcomes. *Journal of Biotech, 5*(1), 53-68. https://unikastpaulus.ac.id/jurnal/index.php/jipd/article/vie.w/266

Sudjana, N. (2011). Assessment of teaching and learning outcomes. *Bandung: PT. Remaja Rosdakarya*.

Suprijono, A. (2009). Cooperative Learning Teori dan Aplikasi Paikem. Yogyakarta: Pustaka Pelajar

Surahman, E., Sulthoni, S., Ulfa, S., Husna, A., Ramdiana, H., At Thaariq, Z. Z., Setiawan, A. B., & Qolbi, M. S. (2020). TPACK-Based Micro-Learning Object Training for High School Teachers in Garut. Abdimas Pedagogi. *Scientific Journal of Community Service, 3*(1), 1. https://doi.org/10.17977/um050v3i1p1-14

Yuhana, U. L., Yuniarno, E. M., Rahayu, W., & Pardede, E. (2024). A Context-based Question Selection Model to Support the Adaptive Assessment of Learning: A study of online learning assessment in elementary schools in Indonesia. *Education and Information Technologies*, *29*(8), 9517-9540. https://link.springer.com/article/10.1007/s10639-023-12184-8

Zellatifanny, C. M. (2020). Trends in disseminating audio on-demand content through podcast: An opportunity and challenge in Indonesia. *Pekommas*, *5*(2), 117-132. https://www.neliti.com/publications/518797/trends-in-disseminating-audio-on-demand-content-through-podcast-an-opportunity-a