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Learning Model Innovation Analysis: Flipped Classroom Integration with Microlearning

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Abstract

Biology subjects contain abstract concepts, one of which is the concept of the respiratory system. The number of concepts that need to be mastered and the short duration of active learning, such as practicum, increase students' cognitive load, students' initial knowledge is low, and there is a possibility of misconceptions. This study aims to design an innovative learning model by synthesizing the results of published research analysis from 2014 -2023. The results of the analysis of various literature reviews developed a learning model that integrated the flipped classroom strategy, microlearning, Google Docs technology, 7taps, and MindMiester. The learning model was developed based on the stages of Ausubel's theory, which includes advanced organizing, presentation, and reinforcement. The innovative model developed can be an alternative to reduce cognitive load and increase students' prior knowledge and the duration of active learning in class.

Keywords*: Innovation, Learning model, Flipped classroom, Microlearning*

1. Introduction

One of the subjects that emphasizes understanding concepts is biology. Biology is a science that studies living things and their environment (Setiawan, 2019; Urry et al., 2021). Learning biology at school requires students to understand, apply, analyze conceptual and procedural knowledge, and apply it to solve problems (Aqil, 2017; Aripin et al., 2021). This is in line with the demands of the Indonesia 2013 curriculum, which states that biology learning emphasizes increasing students' active role in collecting and rearranging information from various sources. (Setiawan, 2019). Biology learning must achieve the four competency objectives of the 2013 Curriculum which include competencies in spiritual attitudes, social attitudes, knowledge, and skills (Agnafia, 2019)

In Indonesia, Biology is a subject known to tend to be rote (Suryanti et al., 2019). This can cause students to have difficulty understanding biology lessons because studying biology is not basically memorizing all aspects of the material but rather understanding its concepts. (Yusup, 2018). Regarding the material studied, biological material is related to concepts from concrete scientific facts and concepts from abstract objects. (Aisyiyah & Amrizal, 2020; Ramadhani et al., 2016) These material concepts are the basis for understanding the material being studied. Students may experience difficulties in studying biology because of the complex concepts and terms; besides that, biology challenges students to form an integrated understanding from the microscopic to the macroscopic scale. (Suryaningsih, 2018; Noviati, 2020).

Biology material has many concepts that must be understood, so mastery of the concepts is very important for every student. Mastery of concepts is students' ability to understand learning material and its application in everyday life (Astuti, 2017). Various concepts in biological material and the different ways of presenting the material by each book author are factors that trigger the emergence of misconceptions.

Misconceptions refer to a concept that does not correspond to the actual understanding put forward by experts in the field. Misconceptions will prevent students from understanding the material. Misconceptions are concepts irrelevant to the opinions of experts in the field (Ramadhani et al., 2016) and are a complicated obstacle that should not be ignored. This is done so that the process of receiving knowledge from students is not hampered (Siswana et al., 2017). Misconceptions will make it difficult for students to understand new material taught by teachers in classes at a higher level. In fact, most teaching staff do not analyze or even know the misconceptions of books that will be

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used as learning references in class, so they will impact learning and understanding of the material on a concept.

Misconceptions in learning often occur in elementary, middle, high school, and university circles. Misconceptions will hinder the process of assimilating new knowledge within students, so it will have an impact on student success in the subsequent learning process. This reinforces that misconceptions are dangerous because they will give people the right thoughts and feelings in understanding the concept, which then becomes an obstacle to constructing new knowledge from the knowledge they believe in. (Puspitasari et al., 2019). Students' initial knowledge of the initial concept is wrong, or the concept is correct, but connecting it to the next is wrong, which becomes the basis for misconceptions. It is possible that misconceptions can occur in many groups, including Generation Z.

Generation Z (Gen Z) was born and raised in the advancement of digital technology. Gen Z's learning process relies predominantly on the use of technology (Andujar & Medina-López, 2019). The use of technology, such as applications on smartphones or videos, is preferred by this generation compared to traditional learning (Szymkowiak et al., 2021). However, this generation's digital usage skills also have weaknesses, especially in learning. Generation Z students have low motivation and learning involvement (Saxena & Mishra, 2021), tend to give up when given a difficult challenge (Seibert, 2021), and require active learning that is rich in learning experiences (HernandezMenendez et al., 2020). One active learning that can provide challenges and increase student motivation and involvement is by using the practical work-learning method

Practical work is a learning process where students carry out experiments by experiencing something they are learning for themselves (Supriatno, 2013). Practical work has its own advantages compared to other learning methods, namely: students immediately gain experience and skills in carrying out practicum, increase student participation both individually and in groups, students learn to think through the principles of the scientific method or learn to practice work procedures based on the scientific method (Millar, 2004). Practical work is very effective in achieving all domains of knowledge simultaneously, including training so that theory can be applied to real problems (cognitive), training in planning activities independently (affective), and training in the use of specific instruments (psychomotor)(Widodo, 2021). However, unfortunately, practicum activities generally only consist of verification, and there is no feedback to students because of the short lesson hours.

Short lesson hours hinder the implementation of school practicums (Rahmah et al., 2021). This obstacle becomes even more real if no laboratory assistants or laboratory staff at the school prepare practical activities (Sudargo & S, 2015). The teacher then needs to prepare materials and give demonstrations, and students carry out activities until the lesson is over. Finally, evaluation or providing feedback to students only takes the form of making reports, often assessed without feedback. Active learning activities only improve students' skills in practical work but do not link the objects/phenomena found with existing theories (Supriatno, 2013). Availability of practicum time is essential in carrying out practicum.

Based on the explanation above, it is known that some aspects need to be reviewed by teachers so that Biology learning, especially practical work, becomes meaningful. Misconceptions of students' prior knowledge must be formed before the practicum begins. Practicum time needs to be more effective so that active learning and providing feedback on evaluations can be carried out. Laboratory Activity Design (LAD) must be by the targets or students, namely Generation Z, who are growing and developing in the digital world. A designed LAD should describe the activity, guide students in finding objects and phenomena in a structured way, and include a record of the activity (Zidan & Supriatno, 2023). To overcome this problem, a study of learning strategies is needed, especially a learning model. This research aims to introduce an innovative learning model that integrates Flipped Classroom and Microlearning.

2. Method

The literature review method was used in this research to explore more effective learning models. This method is used to look at the learning models carried out in previous research from 2014-2023. The articles themselves are selected and can be accessed in their entirety with the help of Google Scholar. The criteria for articles analyzed are research journal articles with a focus on learning model innovation. Keywords to focus on include (1) “Flipped classroom,” (2) “Microlearning,” (3) “Respiratory System,” and (4) “technological innovation.” The results are then synthesized to become a new learning model innovation that aims to reduce cognitive load and increase students' active learning in practical activities at school.

3. Results and Discussion

Search results from various scientific articles found several study results related to the selected keywords. The results of this study are explained as follows. The Integration of each topic. The literature study results will then be used as an innovative learning model, which will be explained in the next section.

Flipped Classroom

Flipped Classroom is a learning strategy that 'flips' the learning conditions. The condition in question is the traditional learning model where learning is done in class and assignments are done at home (Iglesias-Pradas et al., 2021). In a flipped classroom, learning is done at home or outside the classroom. Students are given concepts or material outside of class via online videos, or other media sources that can be accessed easily (Zainuddin et al., 2022).

Students who have learned through the flipped classroom process will have a deeper understanding and have more time to apply their understanding or students will have more time in active learning (Zainuddin et al., 2019). In a flipped classroom, the teacher acts as a facilitator who guides students through planned activities such as answering questions or providing feedback. The use of the flipped classroom is often used for material that requires in-depth understanding, one of which is Biology (Carrasco et al., 2019). Flipped classroom is a classroom management technique that is used to provide a longer learning experience and activities in the classroom compared to traditional learning.

Previous research shows that the use of a flipped classroom can increase student engagement in classroom learning (Zainuddin et al., 2019). This classroom management technique can also help students be better prepared to receive knowledge during learning (Carrasco et al., 2019). This management can be integrated with various types of technology to provide tasks or provide feedback (Lo & Hew, 2020; Zainuddin et al., 2022). It can be said that this class management helps teachers to increase student motivation and involvement and provides more time in this case for Biology practicum activities.

Microlearning

Microlearning can be interpreted as learning activities on a small scale. Microlearning is used as a strategy in designing learning content into small, focused segments. Microlearning according to Olivier, (2021) oriented towards packaging learning content into specific parts with the hope that: (1) it will be easier to understand, through the use of user friendly technology; (2) synchronous and asynchronous diversity; (3) ease of access to material by users; (4) enhanced resources; and (5) use of interesting features in the Learning Management System (LMS). Microlearning can also be interpreted as bite-sized content which focuses on essential material with a short learning time, namely less than 15 minutes (Kao, 2019).

The application of Microlearning in learning will also motivate students to learn quickly and hone their creative abilities (Carter & Youssef-Morgan, 2022). Microlearning can also make learning material easier to understand and remember for a longer time. This is possible because microlearning presents knowledge or information in small parts so that students are able to digest, understand and remember more easily. (Leong et al., 2022). Microlearning can be integrated with technology that is more attractive to generation Z. Short content can increase student retention, helping make students more active in the learning process. Microlearning can also be integrated when learning is not yet underway, resulting in an interesting learning model for students.

Flipped Classroom Integration with Microlearning as a Learning Model Innovation

This learning model innovation is based on Ausubel's theory which reveals that at the beginning of learning students must try to activate the knowledge they have. Students then link the information they have with the information provided by the teacher and then end by strengthening the connection between concepts (Widodo, 2021). This learning model innovation is based on Ausubel's theory which reveals that at the beginning of learning students must try to activate the knowledge they have. Students then link the information they have with the information provided by the teacher and then end by strengthening the connection between concepts. The model innovation process designed is adapted to the strategies and technologies previously discussed, namely the flipped classroom and microlearning strategies as well as Mindmeister and 7taps technology. The learning method used is the practical method. Other technologies such as Google Docs, YouTube, virtual labs or assessment platforms such as Kahoot! and Quizizz can also be integrated in the proposed model. Details of the innovative learning model designed are explained in Table 1.

Table 1. Flipped Classroom Integration with Microlearning as a Learning Model Innovation

Student's Structure	Stage	Teacher's Structure	Strategy/Methods	Technology
Activate existing knowledge outside the classroom	***Advance Organizer***	Providing direction for students to learn through applications outside of class	Integration of Flipped Classroom and Microlearning	7taps (Linked to Youtube, Virtual Lab & Quiz)
Construction of new knowledge in the	***Presentation***	Guiding students in practical work in the	**E-LAD (Practical Work)**	Google Docs

Student's Structure	Stage	Teacher's Structure	Strategy/Methods	Technology
classroom		classroom		
Organize new concept structures with the help of Applications	***Reinforcement***	Directing students to build relationships between concepts and applications	Assignment to create Concept Maps	Mindmeister

Based on Table 1, it can be explained that in the first stage (advance organizer) students will activate the knowledge they already have outside the classroom with the flipped classroom strategy. The teacher will give directions to students to learn through the 7taps application outside of class to provide initial knowledge to students. In the 7taps application, links have been designed that direct student to learning resources such as YouTube, virtual labs for practicums, or quizzes to enrich students' knowledge. The use of 7taps is intended to make learning content easy to understand or bite-sized content, thereby increasing student knowledge retention. On 7taps there is also a link that directs the LAD that students will carry out at the next meeting. This is intended so that students can prepare themselves either by reading the LAD or watching the YouTube practicum. Integration of these initial stages is important to increase students' initial knowledge and extend practicum time as active learning.

In the second stage (presentation), students will construct new knowledge in the classroom by discovering objects or phenomena from the practicum carried out. Because students have been provided with knowledge or theory outside of class, students are expected to be more active in practicum. The LAD which is created in digital format is also expected to help students fill in and get immediate feedback after filling it out. This also helps teachers in student assessment, especially in large classes. The Google Docs application was chosen because it is the most familiar, does not require a lot of bandwidth and the teacher can control all student participation that has been filled in. The activity continues until all groups find the object/phenomenon and complete the questions on the LAD.

Longer time after the practicum can be used as reinforcement or the third stage of this model innovation. Students will organize the structure of new concepts with the help of the Mindmeister application. The teacher will give instructions to form a concept maps (mindmaps) with propositions so that he can identify which students are conceptualizing. Students will also strengthen the relationship between concepts with this application because it is interactive and can be done with the help of students' smartphones. The teacher will provide justification if there is a wrong concept of the proposition made by the student. This is important to strengthen students' concepts so that they can be better understood by students.

All stages of the innovation model have a level of flexibility where they can be used in other topics or chapters that use practicum methods. Integration with other technologies can also be done because there are links that can be saved either in Google Docs, 7taps or Mindmeister. Ease of access using smartphones is also the reason that this model can be a solution to the proposed problem formulation.

Implementation of Flipped Classroom Integration with Microlearning in Respiration Topic

The implementation of innovative learning models is exemplified in the respiratory system material. The choice of this material was based on the fact that it had abstract material with practical activities as active learning. This material has basic competencies according to the revised 2013 curriculum which can be seen in Table 2.

Table 2. Basic Competencies and Learning Achievements in Respiratory System Topic

Basic Competencies (K.13 Revisi)
3.8 Analyze the relationship between the structure of the tissues that make up the organs in the respiratory system and relate it to the bioprocess so that it can explain the respiratory process and functional disorders that may occur in the human respiratory system through literature studies, observations, experiments and simulations.
4.8 Presenting the results of analysis of abnormalities in the structure and function of respiratory/respiratory organ tissues that cause disorders of the human respiratory system through experiments in various forms of presentation media

Based on Table 2, it is known that this material has abstract material, especially on the analysis of the relationship between the structure of the tissues that make up the organs in the respiratory system and the bioprocesses that occur. One method for teaching students about this concept is through practicum. Practical work on measuring factors that influence the respiratory system in animals can be implemented. The Ausubel theory-based learning model can be applied in stages including advance organizer, presentation and reinforcement. The implementation of learning model innovations is explained in Table 3.

Table 3. Implementation of Flipped Classroom Integration with Microlearning in Respiration Topic

Condition	Stage	Description	Learning Model Innovation
Outside Class (Flipped Classroom)	***Advance Organizer***	Students understand essential concepts via 7Taps application.	Microlearning on 7taps helps students understand concepts easily. Flipped Classroom helps students master the material earlier before practicum
Outside Class (Flipped Classroom)	***Advance Organizer* (2)**	Students understand the practical procedures in E-LAD with the help of demonstrations or simulations	E-LAD makes it easier for students to access practical plans, 7taps can be integrated with YouTube links (demonstrations) or virtual labs (simulations)
Inside Class	**Presentation**	Students carry out practical activities with the help of E-LAD. Students are better prepared because they have prior knowledge. Active learning time for students becomes longer	E-LAD is used as a guide for practical activities. Microlearning helps with prior knowledge. Flipped Classroom helps extend active learning time.
Inside Class	**Reinforcement**	Students fill in their observations and questions via E-LAD.	E-DKL can be used as a medium to provide feedback and measure the participation of students working in groups
Inside Class/ After Class	**Reinforcement (2)**	Students organize and strengthen new concepts by creating propositions via Mindmeister.	Teachers provide feedback to students with misconceptions both online and orally.

The Laboratory Activity Design will be converted into E-LAD form which will then be uploaded to the Google Docs platform. Teachers can provide feedback or check student participation in group learning with Google Doc. Student contributions are recorded in the contribution history section. The E-LAD that has been prepared will be shared in the form of a link. The link from E-LAD will be inserted on 7Taps so that it can be accessed by students. In the application there is also a link that directs students to access YouTube to see demonstrations of practical activities. If possible, there is a link that directs you to a simulation platform in the form of a virtual lab. Using this strategy, it is hoped that students will have the freedom to seek knowledge that is considered easy for students to understand. This is one example of applying feedback to students on Google Docs is illustrated in Figure 1.

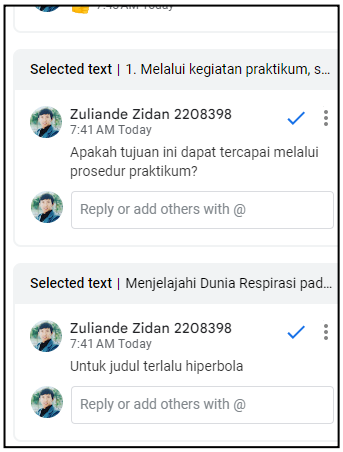

Figure 1. Providing Feedback in Google Docs

Based on Figure 1., it is known that teachers can interact with students and assess students' parts in real-time. This can help students to correct incorrect or erroneous concepts related to the material being studied. The essential material presented in the 7taps application is explained in Figure 2.

Figure 2. Respiratory System Essential Material on the 7taps Application

The essential material described in Figure 2 is arranged according to the microlearning concept. It is recommended that essential material use images and content that does not contain too much writing. In the final stage, namely strengthening, students will make meaningful propositions via Mindmeister. The way teachers check the accuracy of concepts is seen from propositions, for example in Figure 3.

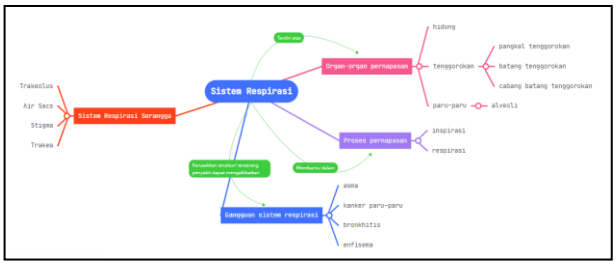

Figure 3. Example of Propositions for Insect Respiratory System Topic on Mindmeister

Based on Figure 3., the bolder colored parts of the row indicate propositions that students can form. The more complex the mindmaps formed by students, the easier it is for teachers to identify student misconceptions. Teachers can provide input verbally or online to students who indicate misconceptions. This stage is expected to strengthen students' understanding of concepts through a learning model based on Ausubel theory. The provision of mindmeister is expected to take place during learning hours. However, if you don't have time, you can do it after the end of the learning hour because the teacher can still provide feedback online via the application.

4. Conclusion

The flipped classroom strategy as an innovation model based on Ausubel theory can be an alternative for reducing cognitive load, increasing students' prior knowledge and the duration of active learning in class. This strategy is integrated with technology, namely 7Taps as Microlearning and Mindmeister as strengthening students' concepts by forming propositions from the concepts they have learned. The E-LAD is used to facilitate the assessment process and support the interests of generation Z who are close to digital. Learning model innovations can be implemented in various subjects with the same scheme. However, further testing stages of the proposed learning design are needed to measure the effectiveness of the strategy design. It is hoped that this Ausubel theory-based learning model innovation can make practical activities more interactive and support the needs of generation Z who is growing and developing in the digital world.

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