JURNAL BIOTERDIDIK: WAHANA EKSPRESI ILMIAH
(*Journal of Bioterdidik: Scientific Expression Media*)

e-ISSN: 2621-5594
p-ISSN:

Vol. 11 No. 2, October 2023, page. 172-188
http://jurnal.fkip.unila.ac.id/index.php/JBT/
doi: 10.23960/jbt.v11.i2.28827

Implementation of the POGIL Model Combined with a Digital Mind Map Based on Online Learning to Improve Creative Thinking Skills and Student Cognitive Learning Outcomes at SMAN 2 Malang

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Received: October 13, 2023 *Accepted: October 23, 2023* *Online Published: October 30, 2023*

Abstract: Education in 21st Century has supported use of the 2013 Curriculum which demands skills, one of which is creative thinking skills. This skill demand is inversely proportional to the real conditions in class XI MIPA 3 SMAN 2 Malang. Initially, creative thinking skills showed an average of 50.20%, indicated that student still had difficulty writing many different answers and were not equipped with details, used the language of books and the internet, did not see problems from various directions. Low cognitive learning outcomes are proven by the 2020/2021 odd semester exam scores with 41.39% of students getting scores below the KKM. Teachers have difficulty implementing learning models during the Covid-19 pandemic. The research aims to improve creative thinking skills and cognitive learning outcomes using the POGIL model combined with a digital mind map based on online learning. The research aims to improve students' creative thinking skills and cognitive learning outcomes using POGIL model combined digital mind map based on online learning. The method uses Classroom Action Research with Kemmis & Mc Taggart design. Collecting data through creative thinking questions from UKBM, digital mind map, and pretest-posttest. The results of the cycle I and cycle II showed an increase in creative thinking skills from 78.37 to 86.26 (UKBM) and 83.74 to 91.50 (digital mind map), the average class cognitive learning outcomes from 78.90 to 80.29, and classical cognitive completeness by 80.65% to 87.10%. The increase was due to the integration of guided inquiry, cooperative, and digital mind map that we're able to create an active atmosphere, creative thinking, teamwork, and concept formation.

***Keywords*:** *creative thinking skills; cognitive learning outcomes; POGIL; digital mind map; online learning.*

INTRODUCTION

Education in the era of disruption in the 21st century is characterized by the use of the 2013 Curriculum (K-13) which leads to the development of attitudes, knowledge and skills to improve the quality of human resources that can survive in the face of global competition. The integration of 21st Century skills in biology learning is based on K-13 goals in accordance with Minister of Education and Culture Regulation number 69 of 2013, one of which is forming creative Indonesian citizens (Kemendikbud, 2013). Creative thinking skills are characterized by students' ability to create, produce, create new things, and practice imaginative thinking to solve problems (Greenstein, 2012). This skill is important for every individual to create ideas or ideas that are varied, unique, original, and responsive quickly in solving problems.

The fact is that in Indonesia, the integration of creative thinking skills in K-13 has not been optimal. 2015 Global Creativity Index (GCI) data shows that Indonesian people's creative thinking skills are ranked 115th out of 139 countries with a value of 0.037 in terms of aspects of technology, talent and tolerance in the fields of science and technology (Florida et al., 2015). This explains that elementary school to university graduates have not been able to come up with creative solutions to problems because teachers lack training and the habit of thinking creatively (Sarwinda, 2013). Some teachers only focus on assessing attitudes and knowledge. Creative thinking skills are related to students' cognitive factors. The results of the 2018 Program for International Students Assessment (PISA) show that Indonesia is ranked 73rd out of 78 OECD countries (Tohir, 2019). Hadi & Novaliyosi, (2019) explained that Indonesian students still have difficulty answering cognitive and application domain questions with a high difficulty index.

The low level of global creative thinking skills is directly proportional to the real conditions in class The average fluency indicator was 53.44%, seen from the answers of students who were not able to write 5 or more ideas or alternative answers that were relevant to the topic of the question. One of the fluency indicator questions consists of being presented with two pictures of human skeletons and students are expected to express ideas from these pictures. On average, students' answers only wrote 2-3 different and relevant alternative answers, such as 1) picture A is the appendicular skeleton and picture B is the axial skeleton, 2) the appendicular skeleton consists of the shoulder girdle, upper limbs, pelvic girdle, lower limbs, 3) the axial skeleton consists of the skull, sternum, ribs and vertebrae. Students have not expressed ideas in depth such as relating to function, types of bones and the number of bones that make up them. The average originality indicator was 52.37%, indicating that some students' answers were not very unique and logical, relatively new and relevant to the problem and had not been expressed in their own language. One of the originality indicator questions is related to revealing and explaining unique problems (diseases) surrounding the movement system in everyday life, but the students' answers explain a) less common diseases such as Wilson's disease, essential tremor, restless legs syndrome, and Parkinson's disease, b) has not explained logically the cause of this disease often occurring, c) several answers have still been found using the language of books and the internet. The average elaboration indicator was 48.28%, indicating that students' answers were not equipped with logical and in-depth details to clarify. One of the elaboration indicator questions is explaining the impact caused by the phenomenon of sprained ankles, but some students' answers only explain the impact without accompanying consequences or detailed explanations. The average flexibility indicator was 46.69% because students had not expressed answers from various points of view, had difficulty understanding the meaning of the questions and were still fixated on answers from books or the internet. One of the flexibility indicator questions is explaining the relationship between images of the process of bone formation and fetal growth to adulthood, but the students' answers only interpret separately images of the process of bone formation and fetal growth to adulthood without linking the two images from various directions such as connecting the process of bone formation from infancy to adulthood. .

Low creative thinking skills can affect learning products, one of which is the cognitive domain. The results of teacher interviews on October 15 2020, explained that the cognitive abilities of XI MIPA 3 students were still low because students were less able to understand the meaning of the questions, lacked focus when learning (working on other lesson projects), speed and learning styles between students were different. This is proven by the results of the 2020/2021 odd semester exam showing that 41.93% of students had grades below KKM and has not yet achieved classical class completion.

Online biology learning during the Covid-19 pandemic does not prevent teachers from practicing creative thinking skills and improving students' cognitive learning outcomes through the use of relevant media and technology, such as digital mind maps. Digital mind map is a form of conveying information digitally which consists of a central idea and is expanded through branch ideas in the form of a structured network complete with images (Chen et al., 2019). Digital mind maps can be used to improve creative thinking skills as evidenced by students' skills in creating keywords, explaining many concepts and solutions in depth, writing relationships between concepts that are easy for readers to understand, and using mind map components. Putri's research results (2016) explain that making a mind map on Excretory System material can increase flexibility through creating many concepts (>20 concepts), elaboration by explaining problems in depth (>35 branches), and originality (creating different keywords).

Another advantage of creating a digital mind map is that it can support improved cognitive learning outcomes. Students can map their thoughts using their own language, add pictures and videos to make things clear, and use coherent colors and symbols to make it easier to remember the concepts written. Handoko et al., (2016) explained that creating a digital mind map can make it easier to channel information explicitly and reduce memorization. One of the digital mind map applications that can support students' creative thinking skills and cognitive aspects is CoggleTM. Kamrozzaman et al., (2019) explained that CoggleTM is useful for making it easier to construct ideas and improve memory, integrate ideas and create tasks. The advantage of CoggleTM is that it can support the use of mind map components such as adding images, videos, links, symbols and colors, facilitating students to collaborate and make presentations. Nong et al., (2009) added that making digital mind maps can support the formation of team performance and students' self-confidence in contributing ideas well.

During the Covid-19 pandemic, biology XI MIPA 3 teachers were unable and had difficulty implementing appropriate learning models, indicating that they did not provide PBMP sheets to students. Apart from that, the results of the interview explained that the even semester material is related to internal mechanisms that are invisible, such as in the Respiratory System material, topics a) internal and external respiration bioprocesses, b) chemical reactions of exchanging O2 with blood, c) breaking down sugar into O2 and H2O, and Excretory System material topics a) chemical reactions in the metabolism of urea, ornithine, citrulline, arginine, b) how the blood filters substances that are needed and excreted physiologically, c) the relationship between organs and disorders or diseases of the Excretory System. An appropriate learning model is needed to support the use of digital mind map media in improving students' creative thinking skills and cognitive learning outcomes during online learning. Isti & Nisa (2013) explain that creative thinking skills can be trained through learning that supports student activity, changes perspectives towards divergent, and connects the learning environment with creative thinking. The appropriate learning model is Process Oriented Guided Inquiry Learning (POGIL).

The POGIL model is a combination of guided and cooperative inquiry that involves students' activeness in forming and understanding concepts (Şen et al., 2015). Hanson (2006) explains that the POGIL model involves team performance, guided inquiry to strengthen understanding, asking questions to train critically and analytically, problem solving, reporting, metacognition and individual responsibility. The POGIL model stages consist of orientation, exploration, concept formation, application and closure. The reason for combining the POGIL model with a digital mind map is because each learning stage contains indicators of creative thinking skills such as orientation supporting fluency, exploration supporting flexibility, concept formation in the form of creating a digital mind map, and application through solving questions that contain indicators of creative thinking skills (fluency, flexibility, originality, elaboration, and metaphorical thinking). The concept formation stage supports creative thinking skills through creating a digital mind map that utilizes the performance of both brains by paying attention to indicators of fluency and flexibility (writing at least 20 concepts quickly), originality (using images and keywords that are different from other people's), elaboration (elaborating on the concept in depth at least 35 branches), links (relationships between ideas that can be understood well), and structure (using mind map components). This is in line with research by Rohmah & Muchlis (2013) that the POGIL model can bring out students' creative thinking skills. Pratiwi et al., (2019) shows that the POGIL model syntax can improve students' creative thinking skills, especially fluency and flexibility indicators. This research explains that the stages of the POGIL model begin with observing problems to generate many ideas or alternative solutions (supporting fluency) and the problems given by the teacher can train students to look for answers from various points of view (supporting flexibility). The combination of the POGIL model combined with a digital mind map based on online learning supports improving student cognitive learning outcomes. This is in line with research by Zamista & Kaniawati (2015) that cognitive learning outcomes can be improved during the implementation of the POGIL model. Students can change the descriptive nature of biological material by utilizing the left and right brain in constructing concepts that are more concise, easy to understand, and interesting through the addition of mind map components.

Application of the POGIL model combined with digital mind maps based on online learning using Google Classroom for group discussion activities and collecting assignments, followed by CoggleTM for creating digital mind maps and Google Meet for validating one class' answers. Rahayu & Pahlevi (2021) support the use of Google Meet to overcome the shortcomings of Google Classroom and boredom through virtual presentations. Online learning is carried out synchronously and asynchronously to overcome time limitations.

Based on the description above, this research aims to improve creative thinking skills and cognitive learning outcomes of XI MIPA 3 students at SMAN 2 Malang through the application of the POGIL model combined with digital mind maps based on online learning.

METHOD

The type of research is Classroom Action Research (PTK). PTK design refers to Kemmis & McTaggart which consists of planning, action followed by observation and reflecting (Yudhistira, 2013:48). PTK is carried out at least two cycles to find out whether the treatment given has or has not been successful in overcoming problems in the class. The research took place at SMAN 2 Malang, Jalan Laksamana Martadinata, Number 84, Sukoharjo, Klojen, Malang City. The research period starts from November 2020-June 2021. The research subjects are 31 students of XI MIPA 3 even semester 2020/2021, consisting of 21 female students and 10 male students.

Researchers conducted a needs analysis before the planning stage through interviews with Biology XI MIPA 3 teachers, students' creative thinking tests on Human Movement system material and online learning observations on WhatsApp. In the planning stage, the teacher creates a POGIL model syllabus and lesson plans combined with a digital mind map based on online learning, UKBM is equipped with an assessment of creative thinking skills, prepares creative thinking assessment instruments from a digital mind map, pretest-posttest questions are equipped with assessments, observation sheets on the implementation of teacher and student learning, validation instruments for material experts, tools and Biology education practitioners. The instrument was validated by 3 validators who are competent in their fields.

In the action stage, the teacher carries out learning according to the RPP that has been designed. Learning is carried out synchronously and if it is not finished, it continues asynchronously, such as making tools and practicum activities. The material discussed is the Respiration System (cycle I) and the Excretion System (cycle II). Preliminary activities include a pretest via Google Form (beginning of the cycle), downloading and reading UKBM instructions. The orientation stage is carried out in Google Classroom, namely the teacher conveys the topic, apperception, objectives, learning outcomes to be achieved, questions about phenomena in UKBM and guides problem formulation. The exploration stage is carried out in Google Classroom, namely the teacher guides students to create hypotheses and procedures, carries out asynchronous practicums, collects and links data with hypotheses. The teacher provides a practical video to be analyzed and linked to the hypothesis created. Individual practicums are carried out asynchronously and documented in video form. The concept formation stage is where the teacher invites students to form concepts from guided questions in the form of a digital mind map using the CoggleTM application. Making digital mind maps to train students' creative thinking skills. In the application stage, the teacher facilitates students to work on questions at UKBM to hone creative thinking skills and present overall answer results via Google Meet. The closure stage consists of presenting conclusions, reflection and self-assessment. Closing activities, the teacher asks about material that is not yet understood, gives assignments and posttests (end of cycle).

Observation stage, observers observe students' activities when working on UKBM and digital mind maps to train creative thinking skills, calculate data on creative thinking skills from UKBM according to the assessment rubric according to Zubaidah et al., (2017)), creative thinking skills from digital mind maps according to (Putri, 2016), and cognitive learning outcomes (pretest-posttest). The reflecting stage is carried out after learning, the teacher and observer evaluate the learning and continue together to determine improvements in the next cycle.

The data obtained was qualitative from descriptions of students' activities while working on UKBM and making digital mind maps to train creative thinking skills. Quantitative data was obtained from calculating the number of descriptors that appeared divided by the maximum score multiplied by 100 for creative thinking skills from UKBM and digital mind maps. Cognitive learning outcomes are calculated based on a ratio of 4:8 for multiple choice and essay scores. The data processed and analyzed consists of (1) creative thinking skills from UKBM and digital mind maps which are said to be complete if a score is ≥ 75 (Isti & Nisa, 2013), (2) cognitive learning outcomes are said to be complete if students get a score ≥ 75 (SMAN Curriculum 2 Malang FY 2020/2021) with classical class completeness ≥ 80% and increased cognitive learning outcomes from N-gain are said to be good if g>0.3 (Rostiana, 2015: 151).

RESULT AND DISCUSSION

Learning will be held on Tuesday, February 9-March 16 2021 at 08.30-10.00 WIB. The Respiratory System material is divided into 3 meetings, namely (1) Organ Structure and Function of the Respiratory System, (2) Bioprocesses, Factors that Influence Respiration and Air Volume, (3) Disorders and Technology in Respiratory Organs. Excretory System material consists of (1) Structure, Function and Bioprocess of Lung and Kidney Organs, (2) Structure, Function and Bioprocess of Liver and Skin Organs, (3) Disorders and Technology in Excretory Organs.

Preliminary activities begin with a pretest (beginning of the cycle) via Google Form, followed by downloading and reading the UKBM instructions. The orientation stage consists of preparing students physically and psychologically through apperception linked to the goals and learning outcomes to be achieved. The teacher asks questions via video links or phenomena in UKBM and invites students to formulate problems individually. The number of problem formulations made by several students in learning activities 1 and 2 of cycle I was around 3-4 and was less directed towards the topic being studied. However, in the 3 learning activities of cycle I and the learning activities in cycle II, the number of problem formulations was already large and began to match the topic. This stage is to train students' fluency based on the number of problem formulations according to the material topic.

The exploration stage involves inviting students to formulate hypotheses, gather with groups and develop practical procedures, watch practical videos, collect and relate data to hypotheses based on the video. Students create individual tools and practicums and document them (asynchronous). Videos of practical activities that have been made will be shown during class presentations. Hypothesis making in cycle I is less directed from various points of view and tends to look from one direction, but can be overcome through teacher guidance in cycle II. This stage trains students' flexibility through making hypotheses and drawing conclusions from the hypotheses with the data obtained.

The concept formation stage consists of creating a digital mind map cooperatively based on conceptual guided questions. Students are very interested and explore CoggleTM by utilizing various features such as group discussions, adding images, videos, symbols and the use of color. The results of making digital mind maps for several groups in learning activities 1 and 2 of cycle I still did not add symbols or videos and still found the use of different colors in one topic. The teacher's direction and input made the learning activities in 3 cycles I and the learning activities in cycle II good and paying attention to indicators of creative thinking. Making digital mind maps supports the formation of creative thinking skills for indicators of fluency & flexibility, originality, elaboration, links and structure. A sample of the results of creating a digital mind map on the topic of Respiratory System Disorders and Technology can be seen in Figure 1.

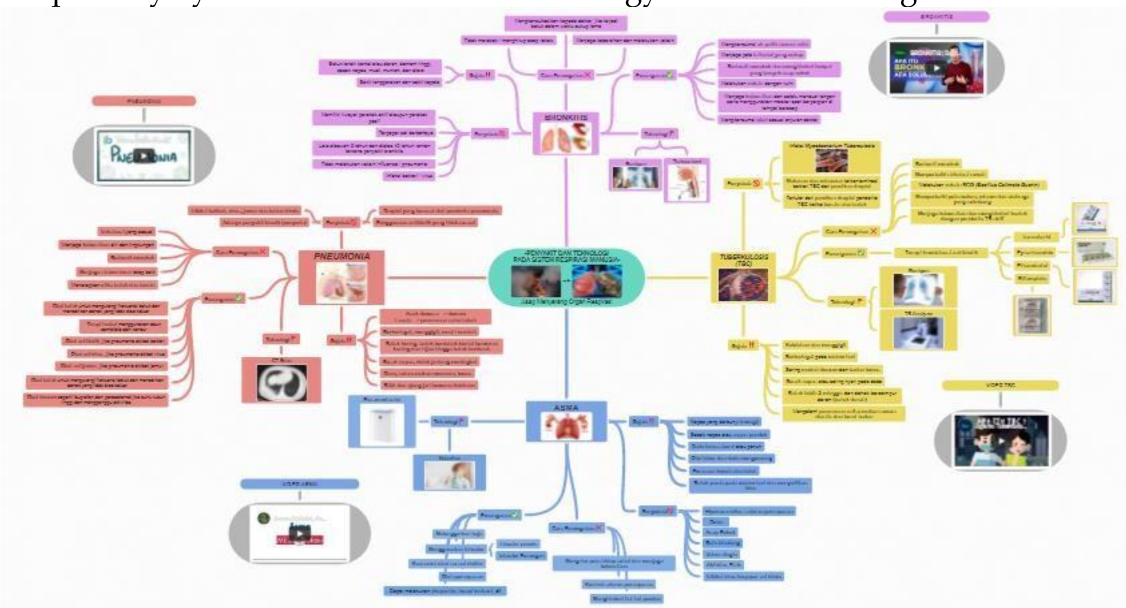


Figure 1. Sample of Digital Mind Map Results for Creative Thinking Skills Regarding Symptoms, Causes, Prevention and Technology in the Respiratory System

The results of making the digital mind map for group 3 above support the formation of creative thinking skills as evidenced by the skill of writing 25 concepts quickly which are divided into 4 respiratory system disorders, namely asthma, pneumonia, bronchitis, and tuberculosis (fluency and flexibility), explaining in-depth concepts with a total of 83 (elaboration), using different images and keywords on each topic (originality), the relationship between ideas is easy to understand (link) because it is equipped with mind map components (structure) such as the use of different colors between topics (asthma is blue, disease pneumonia is pink, bronchitis is purple and tuberculosis is yellow), using symbols for each concept, keywords written in capital letters and bold, as well as adding videos to clarify the material being studied. Inserted images can be enlarged and videos can be played. Students present the digital mind map results directly via the CoggleTM application.

The application stage consists of working on contextual questions to hone creative thinking skills. The teacher facilitates students to discuss in the chat room on Google Classroom. Some students were still passive when discussing in the chat room in learning activities 1 and 2 of cycle I, but when the teacher gave reward points their activity got better. Several groups chose to discuss in the Whatsapp group because the signal was weak when opening Google Classroom. The teacher directs students to pay attention to the indicators and important points of the question. The teacher asks about individual or team obstacles during the work. This stage trains creative thinking skills, indicators of fluency, flexibility, originality, elaboration and metaphorical thinking. The teacher asks students to submit their answers to be validated by one class. Each group can express opinions and ask questions to the presenter. If a concept is found that is not appropriate, the teacher gives guiding questions, asks other students and if no one knows, the teacher explains it. A sample of class discussion activities on Google Meet by teachers and students is in Figure 2 below.

Figure 2. Class Discussion Activities on Google Meet Discussing the Results of the Digital Mind Map of Organ Structure and Function of the Respiratory System

Figure 2 shows that answer validation activities are carried out starting from creating problem formulations to delivering reflections. The interesting thing is that there is interaction from various directions virtually between teachers, students, the media and learning resources used. When discussing the results of the digital mind map above, students' answers were found to be inaccurate, such as seromucous glands should be seromucous, golbet cells should be goblet cells, serores glands should be serous, flamen should be filaments, epiglottis valves should be epiglottis, nonperitorial bronchioles should be nonrespiratory. The teacher asks other students to pronounce the correct terms to avoid misconceptions. When discussing questions at the application stage, students' creative thinking skills in answering questions are indicated by the students' varied answers, using their own language, adding details, elaborating and using logical analogies to clarify. This presentation activity can stimulate competition between students in expressing answers and submitting questions. Sample student questions such as "What structures differentiate breathing through the nose and mouth? Why does someone feel earache when they have influenza, is there a connection with the influenza virus? Why does someone get a nosebleed without realizing it and which nasal structures are injured?"

The closure stage consists of the teacher guiding students to make conclusions, reflect and complete a self-assessment. Self-assessment to train students' honesty. If the results are poor, students read the material again and work on competency test questions. In the closing activity, the teacher asks about material that has not been understood, gives assignments in the form of reading the material again and asks students to continue working on assignments that have not been completed, and gives a posttest (end of cycle). Teachers provide motivation and enthusiasm to continue learning. The teacher asks students to collect the results of their work in Google Classroom.

The workability of the POGIL model syntax combined with online learning-based digital mind maps can support improving students' creative thinking skills. Creative thinking skills from UKBM were 78.37 (cycle I) increasing 10.07% to 86.26 (cycle II). The low level of creative thinking skills in cycle I was due to students' activities at the application stage not being optimal, not paying enough attention to key word questions and reading the instructions for creative thinking UKBM work. The increase occurred in cycle II, students had paid attention to keywords and indicators for assessing creative thinking at each stage of the POGIL model in UKBM. Guided inquiry in the POGIL model can train creative thinking skills at the orientation stage through creating problem formulations, exploration through making hypotheses, drawing conclusions from hypotheses and data obtained, as well as application through working on contextual questions that contain indicators of creative thinking. The cooperative approach functions so that students can exchange ideas and see problems from various points of view. Increasing creative thinking skills from each indicator based on working on UKBM questions in each cycle is explained in Figure 3 below.

Figure 3 explains that creative thinking skills increase in each cycle. The highest increase was in the fluency indicator from 74.46 (cycle I) increasing 13.73% to 84.68 (cycle II). The results of several students' answers to the Respiratory System material only provided 3-4 different alternative answers and did not explore knowledge in depth. Deficiencies were corrected in cycle II by inviting students to read various literature related to the Excretory System before studying and at the concept formation stage a digital mind map was created to construct knowledge.

Apart from being trained through working on questions at UKBM, creative thinking skills can also be improved through making digital mind maps. Creative thinking skills from the digital mind map were 83.74 (cycle I) increasing 9.27% to 91.50 (cycle II). This means that the components in making digital mind maps in the concept formation stage, such as creating keywords, using images, videos, symbols, colors, forming concepts and relationships between branches, support the formation of students' creative thinking skills. Not only that, creating a digital mind map can stimulate the brain to construct concepts in a structured manner. Increasing each indicator of creative thinking skills through creating a digital mind map is explained in Figure 4

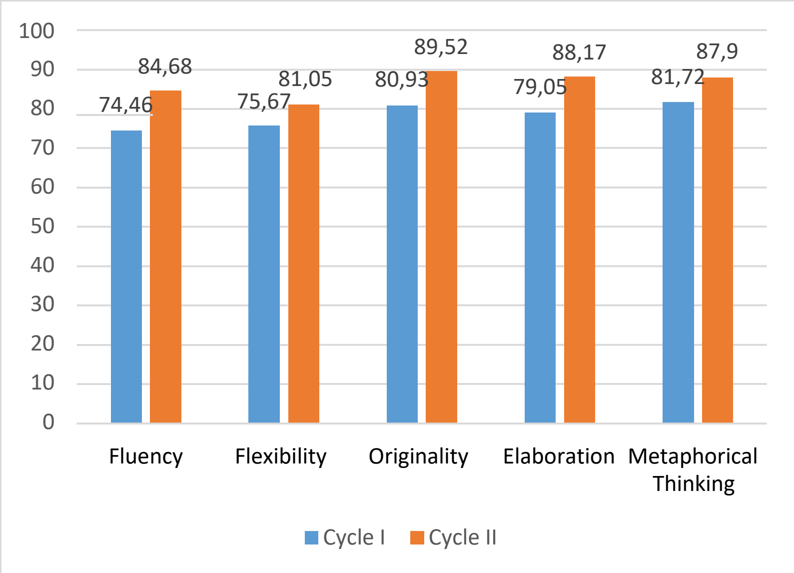


Figure 3. Data on Improving Creative Thinking Skills of XI MIPA 3 Students from Cycle I to Cycle II through Working on Questions at UKBM

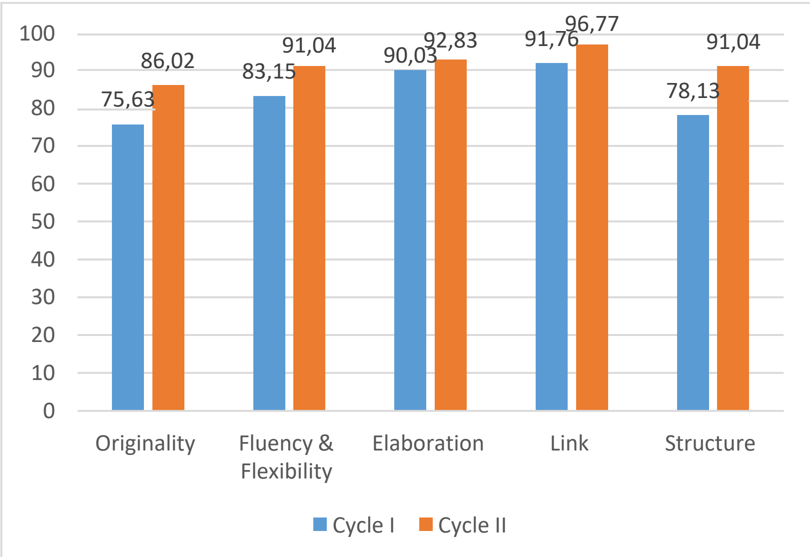
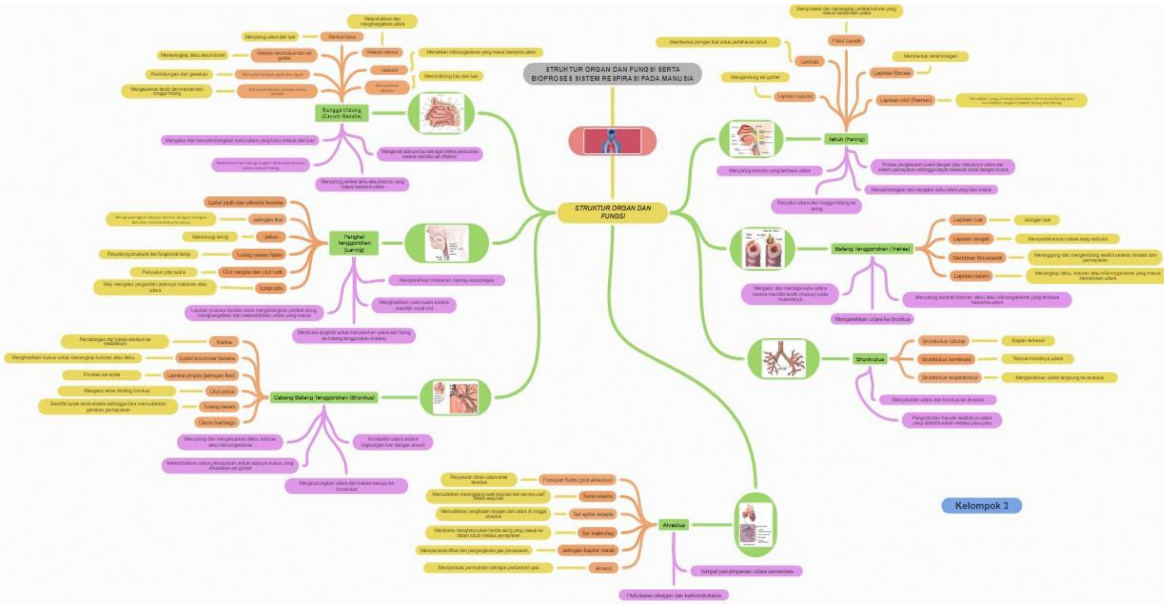


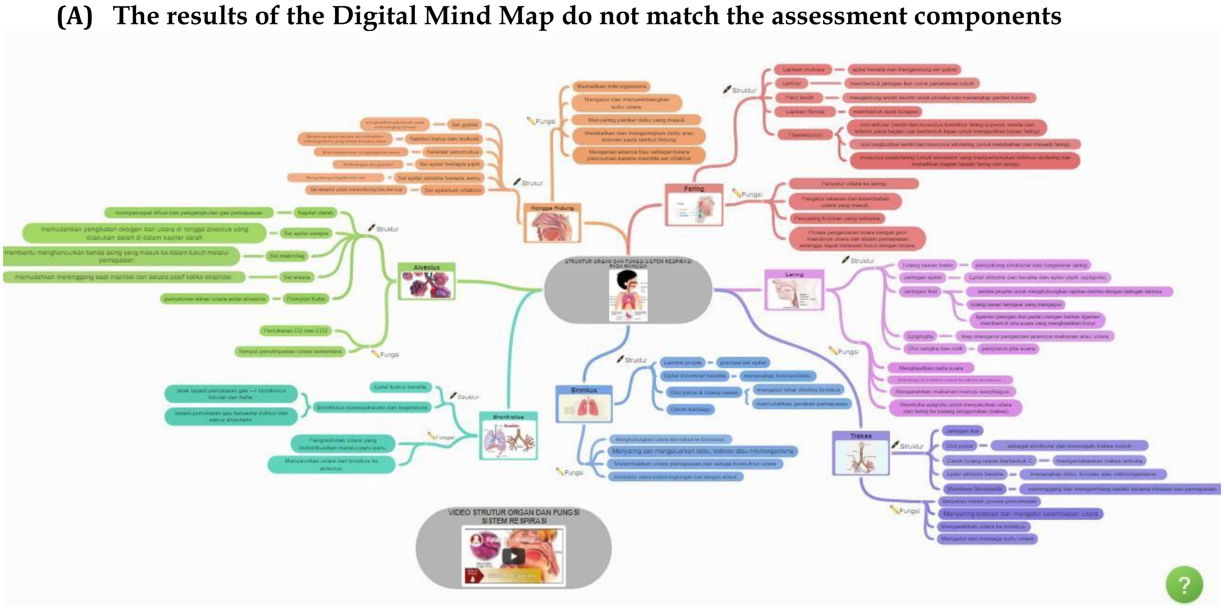
Figure 4. Data on Improving Creative Thinking Skills of XI MIPA 3 Students from Cycle I to Cycle II through Making a Digital Mind Map

Figure 4 explains that creative thinking skills from making digital mind maps increase with each cycle. The highest increase was in the structure indicator from 78.13 (cycle I) increasing 16.52% to 91.04 (cycle II). The low level of structure indicators in cycle I was due to students not using colors and symbols well. Several groups were found to use colors on one subject in a varied manner, were less coherent, and made it difficult for readers to remember concepts. The teacher reminds students to pay attention to assessment indicators such as using the same color in one subject, adding symbols, pictures, and exploring the use of CoggleTM. Students are starting to get used to making digital mind maps, adding videos, and making presentations directly via CoggleTM.

The second highest increase in the originality indicator from 75.63 (cycle I) increased 13.74% to 86.02 as evidenced by the students' good ability to write down central ideas, keywords and the use of different images, especially on the subject of the Excretory System. The third highest increase in the fluency and flexibility indicators from 83.15 (cycle I) increased 9.49% to 91.04 (cycle II) as evidenced by students' ability to write more and more concepts at each meeting, especially at the third meeting of cycle I and other meetings. cycle II. The link indicator experienced the second lowest increase from 91.76 (cycle I) increasing 5.46% to 96.77 (cycle II) as evidenced by the students' ability to write relationships between ideas that can be understood well.



(A) The results of the Digital Mind Map do not match the assessment components



(B) Digital Mind Map Results According to Assessment Components

Figure 5. Sample Results of Making a Digital Mind Map for Creative Thinking Skills

The lowest increase was in the elaboration indicator from 90.03, increasing 3.11% to 92.83. This is because the students' ability to elaborate on the Respiratory System and Excretory System material is not significantly different. Students were able to explain the problem in depth and exceeded 35 branches in learning activities

3 cycle I, while in learning activities 1 and 2 cycle I the number of branches was still found to be around 20-25 concepts. Cycle II gets better at elaborating the concepts studied. The following is a sample of the results of creating a digital mind map on the topic of organ structure and function of the human respiratory system, shown in Figure 10.

Figure 5 explains that the results of making a digital mind map in Figure (A) are not optimal in terms of structure indicators, marked by the use of different colors at each level in one subject (green for keywords, orange for constituent structures, yellow for special functions of respiratory organs and purple for general functions of the respiratory system), and students cannot differentiate between mind maps and concept maps. This can affect the link indicators because using different colors in one subject will make it difficult to understand the relationship between ideas well. The brain's ability to construct concepts is less than optimal. Figure (B) shows that students have been able to practice creative thinking skills as indicated by the ability to write 21 concepts quickly which are divided into 7 structures, special functions and general functions of the respiratory system organs, namely the nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles and alveoli. (fluency and flexibility), explaining in-depth concepts with a total of 60 (elaboration), using different images and keywords on 7 topics (originality), the relationship between ideas is easy to understand (link) because it is equipped with mind map components (structure) such as the use of color different between subjects (orange for the nasal cavity, red for the pharynx, purple for the larynx, dark blue for the trachea, light blue for the bronchi, turquoise for the bronchioles, green for the alveoli), using symbols for each concept, keywords written in capital letters and thick, as well as adding videos of the structure of the respiratory system organs, both anatomy and morphology, along with their functions to clarify the material being studied.

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both anatomy and morphology, along with their functions to clarify the material being studied.

The implementation of POGIL syntax combined with digital mind maps based on online learning can influence students' cognitive learning outcomes. The average class cognitive learning outcome was 78.90 (cycle I) increasing 1.76% to 80.29 (cycle II). The average increase in students' cognitive learning outcomes was not too far from cycle I to cycle II due to discussion activities not being optimal (students were still found to have signal problems), students were found to be late in submitting assignments, and the complexity of the Excretory System material. The classical completion results were 80.65% (cycle I) marked by 6 students having scores below the KKM to 87.10% (cycle II) marked by 4 students having scores below the KKM. The increase in classical completeness is due to the concept formation stage, students are trained to make digital mind maps to make it easier to understand and remember the material and at the application stage they are given questions to train creative problem solving abilities. Data on increasing average cognitive learning outcomes class and classical completeness are explained in Figure 6.

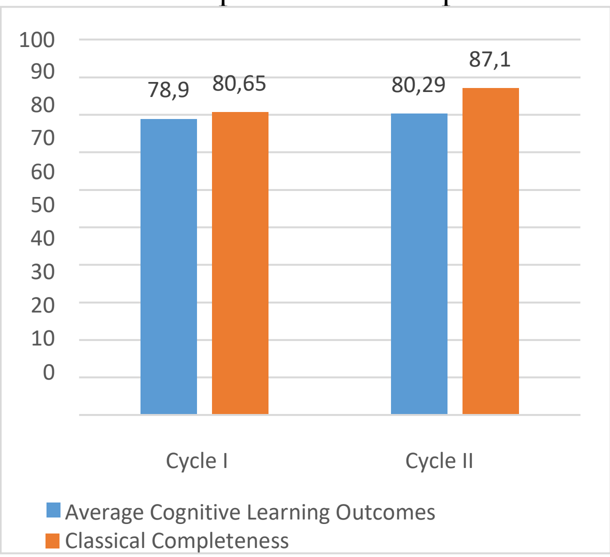

Figure 6. Increase in Average Class Cognitive Learning Outcomes and Students' Classical Completeness XI MIPA 3 in Cycle I and Cycle II

The increase in cognitive learning outcomes based on pretest-posttest scores through the calculation of N-gain in the medium category was 0.78 (cycle I) to 0.86 (cycle II). This means that repeated application of the POGIL model combined with digital mind maps based on online learning can improve students' cognitive learning outcomes. The N-gain increase data for cycle I and cycle II are explained in Figure 7. Figure 7 explains that the increase in cognitive learning outcomes in each cycle is due to the implementation of the POGIL model combined with an online learning-based digital mind map equipped with the creation of a digital mind map to construct concepts that are more concise, interesting and easy to understand. Practice questions at the application stage support problem solving. The more practice questions, the more honed students' cognitive abilities will be. Presentation activities at the application stage can foster competition for both individuals and teams in expressing the concepts that have been discovered. The learning process increases student activity during group and class discussions and focuses learning concentration.

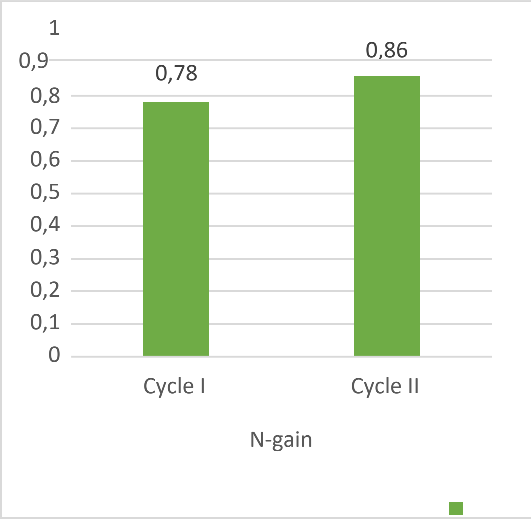

Figure 7. Data on increasing N-gain for cognitive learning outcomes in Cycle I and Cycle II

CONCLUSION

Based on the results and discussion, the application of the POGIL model combined with a digital mind map based on online learning was able to improve students' creative thinking skills from 78.37 (cycle I) to 86.26 (cycle II) through practice questions at UKBM which contained indicators of fluency, flexibility, originality. , elaboration, and metaphorical thinking. Making digital mind maps can support increasing creative thinking skills from 83.74 (cycle I) to 91.50 (cycle II) by paying attention to indicators of fluency and flexibility, originality, elaboration, structure and links. The average class cognitive learning outcomes were 78.90 (cycle I) to 80.29 (cycle II). Classical completion results were 80.65% (cycle I) to 87.10% (cycle II). The guided and cooperative inquiry stages of the POGIL model supported by digital mind map creation can bring out student activity during online learning, thereby improving creative thinking skills and cognitive learning outcomes of XI MIPA 3 students at SMAN 2 Malang.

GRATITUDE

Researchers would like to thank Drs. Hariyanto, M. Pd., as Head of SMAN 2 Malang, Dra. Ruchimah Achmad, M. Pd., as biology subject teacher, students of XI MIPA 3 SMAN 2 Malang, observers and all parties who have helped until the completion of this research.

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