DOI : https://doi.org/10.24036/bioedu.v7i1.443

p-ISSN 2354-8363 e-ISSN 2615-5451//Vol. 7 No.1 Season Year 2023

BIOEDUCATION JOURNAL

http://bioeducation.ppj.unp.ac.id/index.php/bioedu

Biology Learning Innovation in Environmental Change Materials: Approach and Method

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ARTICLE INFORMATION

Article History

Submitted 14-05-2023
Revise 29-06-2023
Accepted 29-06-2023
Published 30-06-2023

Keywords
Biology
Methods
Learning
Approach

ABSTRACT

The object of learning biology is the universe and its contents. However, not all of these objects can be brought to school. One of the biological materials with these characteristics is environmental change material which is taught in class X SMA. On the other hand, teachers have attempted to design strategies to maximize learning, starting from approaches, models, methods, and media. Through biology learning innovations that integrate technology can facilitate more effective and enjoyable learning. The contextual approach with the field study method is very suitable to support learning about environmental change. Therefore, an innovation in biology learning was carried out on environmental change material. This study uses a qualitative descriptive method with data collection techniques, namely literature studies from articles from various journals, websites, and books that are relevant to the topics discussed. The results of this study are recommendations for innovative field study methods and contextual approaches in learning about environmental change with the help of technology. The use of these methods and approaches uses Google Earth technology, Class Tools, IoT, Source Net + HP Camera, Google Spreadsheets, Macroinvertebrates, LiveGap Charts, and Instagram which are expected to produce more meaningful learning.

***How to cite* artikel ?** **Gusti, U. A., Azzahra, W., & Widodo, A. (2023). Biology Learning Innovation in Environmental Change Materials: Approach and Method. *Bioeducation Journal. Vol 7*(1), 10-18.**

INTRODUCTION

Environmental pollution has had a major influence on the well-being of human life. The problem is, various problems come and go due to damage such as floods, reduced availability of clean water, global warming, and many more. Most people still do not understand that one of the causes of the damage occurs in humans. The results of several studies reveal the need to strengthen environmental literacy as an effort to increase public awareness (Nasucha et al, 2020). Besides that, many studies have been conducted to increase environmental literacy in school children (Jayanti et al, 2021; Ihsani & Santoso, 2020; Hartini, 2019). The community assumes that the damage that has occurred is the responsibility of the government so that awareness in maintaining and reducing the damage that occurs does not exist in them. As a result, day by day the damage is getting worse (Gusti et al, 2022; Gusti & Hufa, 2022). One of the steps taken by the government is to provide education from an early age by integrating it into the learning curriculum, namely environmental change material. It is hoped that students will be able to increase environmental awareness and provide education to the wider community.

Environmental change is material given to students at the class X senior high school (SMA) level. In general, the teacher only explains theories about environmental change in class. It cannot be denied that environmental change material is very helpful in shaping students' environmentally conscious character. It is hoped that the teacher will be able to provide this material correctly so that it can help reduce the environmental damage that occurs. This is what makes this material must be taught with real content so that students can reconstruct knowledge correctly based on actual conditions. Therefore, it is necessary to use appropriate approaches and methods in teaching this material so that the learning objectives are achieved. Therefore, it is necessary to use appropriate approaches and methods in teaching this material so that students are more active in class and reduce the damage that occurs.

The method is a way of teaching students. While the approach implies a strategy to achieve the goals chosen when designing learning. The approach is directly related to achieving goals so that goals determine the approach to be chosen (Widodo, 2021). Based on the characteristics of the material content, the need for a contextual approach with field study methods to support learning about environmental change. It is expected that teachers can use appropriate approaches and methods according to learning content. Not all biology objects can be presented to schools (Widodo, 2021). Thus, the need for a contextual approach with field study methods to support environmental change learning. Various studies have revealed the success of this approach in improving student learning outcomes (Ulya, 2016; Sariningsih, 2014; Nengsi, 2021; Agung, 2020; Irhami, 2019; Juliayanti et al, 2022; Munandar, 2022). Not only improve the cognitive abilities of students, it can even improve the attitudes and skills of students. Learning outside the classroom also increases students' awareness of the environment (Dillon et al. 2006). Much research has revealed the success of the field study method in teaching students (Purwantoyo, 2013).

Most of the research only focuses on methods or media. A combination of approaches and methods will result in meaningful and efficient learning. This research is important to do to provide biology learning innovations in environmental change material related to methods and approaches. The results of this study serve as material for consideration and reading sources in learning and subsequent research.

METHOD

The research method used is method descriptive qualitative. Ardial (2014) explains that qualitative research is a multiple reality, so there is no need to use a sample from the population. Kriyantono (2006) emphasizes that this study aims to explain phenomena and events through deep data collection. Through this method, researchers describe problems that occur in the present and provide alternatives solution solving the problem. As for research data were collected through analysis of articles from various journals, websites, and books that were relevant to the topics discussed. Furthermore, the data is used to support the author's ideas and is used as the basis for making articles on innovations in technology-based learning methods and approaches in one unit of information.

RESULTS AND DISCUSSION

A. Innovation of Approach Contextual

The scientific knowledge that will be taught to students is often related to the context of students' lives. Learning that connects the subject matter with the context of everyday life can give students a lot of experience in interpreting problems and may also generate varied ideas for solving problems (Zakiah, et al., 2019). This is in line with constructivism learning theory which states that a person's real-life experience has an important role in the educational process. The teacher is only a facilitator to facilitate students in constructing knowledge. One student-centered approach that has these characteristics is contextual learning. According to Widodo (2021), the contextual approach means that the teacher teaches scientific knowledge by utilizing this context.

Contextual does not always mean that the events or phenomena in question occur around us, but these activities are actual to the conditions when learning will be carried out.

The contextual approach is a learning concept that helps teachers relate the material they teach to students' real-world situations and encourages students to make connections between their knowledge and its application in their lives (Muslich, 2007). In other words, contextual teaching and learning engage students in important activities that help them relate academic lessons to the real-life contexts they face (Johnson, 2002). Furthermore, biology learning needs to be directed at a contextual learning base where students actively construct their knowledge, can think critically, and have independence in learning. In addition, students need to have life skills and the ability to work together, the ability to communicate, the ability to be a diligent learner, and be able to make the right decisions in solving real-life problems. Therefore, in learning it is necessary to have learning with the right innovative approach (Hasruddin, et al., 2015).

Various studies have successfully used a contextual approach in the learning process, including Zakiah (2017) revealed that there was an increase in metacognitive abilities among students who received learning using a cognitive style-based contextual approach (field dependent and field independent). The results of Zakiah and Sunaryo's research (2017) reported that a contextual approach of paying attention to students' cognitive styles was able to improve self-awareness. Furthermore, the results of Sunaryo & Fatimah's research (2018) state that the application of learning using a contextual approach through the scaffolding learning model can improve students' mathematical abilities, namely students' mathematical critical thinking.

Learning innovations carried out by teachers in the classroom are important to optimize learning activities so that they are more meaningful, enjoyable, and can encourage students to construct and develop the knowledge they already have. On the other hand, previous researchers have indicated that inappropriate learning strategies or tools can even reduce learning motivation and cause negative learning effects (Charsky and Ressler, 2011). That is, to help students improve their learning performance, it is important to integrate approaches with appropriate learning technologies as part of the educational process. Using technology, the application of approaches in learning becomes more interesting. One application that supports the contextual approach is the Earth Hero application.

The integrated contextual approach using the Earth Hero application supports meaningful learning. This application contains material about the environment which is equipped with discourse, graphics, animation, and quizzes as reinforcement for learning in the field. Supported by the Instagram application as a documentation tool, the Googloe Form fiber as a data collection tool is expected to be an interesting and meaningful learning alternative for students. The learning activities by implementing a technology-based contextual approach are explained as follows.

1. Use of the earth hero application

   At the beginning of learning, the teacher divides students into several groups. Each group will be responsible for monitoring the implementation “Earth Challenge” of the other group. Earth Challenge is assigned by the teacher to each student and each student can choose what action he might be able to take according to the factual conditions around him. To be able to provide direct assessments of the Earth Hero application, the student's Earth Hero Account can be accessed by students in other groups who are responsible for monitoring their activities. Students in other groups can check the feature "*Mark Achieved*” which indicates that the targeted actions and student assignments have been successfully carried out.

   Learning activities can be carried out through the Earth Heo application starting from simple actions that students can take so that they have a positive impact on the environment. By using the features in the Earth Hero application, students can contribute to the environment, especially by reducing their carbon emissions. These activities can be done anywhere and anytime. In this application, there is a feature that

contains a list of actions that a person can take which is arranged based on the level of impact and difficulty of implementation.

The various features in the application display interesting user views to be explored and it is hoped that someone can take more positive actions towards the environment. In addition, there are always application updates since installing Earth Hero so that information is conveyed up *to date* and more varied. With easy use and accessibility using student gadgets, this application is very helpful in carrying out social missions.

2. Use of the instagram application

Not only limited to social media that can store photos and videos but the Instagram application can also be used by teachers as a tool that helps in learning including biology learning (Aditama et al, 2022; Akbar, 2018; Saputra, 2020; Veygid, 2021). The features provided by Instagram help students in documenting both learning activities and teacher assignments. With its various advantages and conveniences, this application can be used as a technology that can document students' activities in carrying out projects on earth *challenges* given by the teacher. This aims to prove that students carry out the given project.

Features offered by Instagram such as live, stories, photo editing along with the effects provided, hashtags, hashtags, geotagging, reels, and search. The advantages of this application that support student activities in carrying out their actions are easy to use, quickly send photos and videos, can tag locations, and can share activities via links.

Every action taken by students will be uploaded to their personal Instagram application. With the feature "*story*" that this application offers, the activities carried out by students can be seen by other groups whose job is to monitor the activities carried out. Besides that, this activity provides indirect benefits, namely, students can set an example to others regarding the actions they have taken to care for the environment. The hope is that the activities carried out by students will also be implemented by other people so that the positive impact of these actions is increasingly widespread.

3. Use of Google forms

The use of Google forms as a medium for data collection can increase effectiveness in learning and make it easier for teachers to check the performance of students. This was the consideration for selecting Google Forms as an additional technology to support environmental change learning. Google forms are integrated into the Google Drive application which can be accessed for free and easy to use. This technology is currently the most popular choice for use in learning specifically used for assessment and evaluation.

Among the many things that can be done with Google Forms is to make it easy for users to get data from respondents online. The teacher does not need to provide paper or printed documents, it is enough to determine the type of data to be entered, then make it an online form on Google, and then share it via a link with students to start entering data. Forms filled out by students will be accompanied by documentation of evidence of environmental actions they took during learning activities. This allows the teacher to evaluate the actions taken by students.

After students have finished doing *Earth Challenge*, the teacher will check the activities carried out through answers on Google Forms that have been sent by each group that is responsible for assessing the performance of other groups. Besides that, the teacher also receives reports from the students concerned containing descriptions of the problems, causes, and impacts of environmental changes found by students, as well as countermeasures to overcome environmental changes that occur. The report is also accompanied by a link linked to the student's Instagram account so that the teacher can also see first-hand the implementation of the student's actions.

The Earth Hero application as a technology that supports contextual learning is one of the innovations that can be applied in the learning process, especially on the topic of environmental change. The various features offered in this application can help students to be aware of the latest facts and conditions about

their surroundings and move to contribute to protecting the environment. Through this application, students can observe their surroundings, plan, and carry out simple actions to care for the environment, share knowledge through discussions, and can carry out campaigns related to efforts to protect the environment. This makes this application suitable for implementing contextual approaches. As is the concept of the contextual approach, that is, the material taught by the teacher is associated with real- world situations of students and the teacher encourages students to make connections between the knowledge they have and its application in their lives (Muslich, 2007). Besides that, the learning process carried out through this application can also be adjusted to KD or CP in the curriculum used.

Every application used in technology-based learning that is offered requires an internet network. This is one of the obstacles that students might experience when there is no internet connection or when the network conditions are unstable. This can cause learning activities to be disrupted, for example, students cannot upload their activities directly on Instagram as proof of the implementation of the Earth Challenge. Even so, to anticipate these obstacles the teacher must be able to provide solutions as alternative learning activities so that learning objectives are still achieved. For example, students can record their activities using the cell phone camera feature as evidence of activities carried out by students.

B. Innovation of Field Study Method

The method is a technique for teaching students, meaning that students get lessons through the implementation of learning methods. Field study is essentially a method for finding specifics and the reality of what is happening in the midst of life. The field study method also means learning directly from nature (environment) directly because not all biological objects can be brought to school (Widodo, 2021). The purpose of learning outside the classroom is to give each individual a unique opportunity to develop creativity and personal initiative, to provide a meaningful setting for the formation of attitudes, to help realize the potential of each individual so that their body, mind and spirit can develop optimally. Besides that, learning outside the classroom also allows students to develop skills and interest in activities outside the classroom, contributes to helping develop relationships between teachers and students, and utilizes resources that come from the environment and the surrounding community so as to provide opportunities for students to learn. from direct experience (Rohim & Asmana, 2018).

Learning innovations carried out by teachers are important for optimizing learning activities so that they are meaningful, fun, and learning can encourage students to construct and develop the knowledge they already have. That is, to assist students in improving their learning performance, it is important to integrate appropriate learning technologies as part of the educational process, including in selecting the appropriate technology with the learning methods used. Through the use of technology, the application of these learning methods will become more attractive, effective, and efficient.

The author has designed a lesson by applying the field study method by integrating it with the use of technology. This learning innovation is recommended as a fun and meaningful learning for students through observation activities to uncover facts in order to obtain direct data in the field. This field study method learning innovation is focused on water pollution material. Students check water quality based on physical, chemical, and biological parameters. Before activities in the field are carried out, the teacher must socialize the stages of activities to students and ensure that all needs in the field have been prepared. The use of technology that the author designed as an alternative learning solution in implementing field study methods is presented in Table 1 below.

Table 1. Utilization of Technology in the Implementation of Field Study Methods

No	Activity	Technology
1	Determination of Observation Locations	Google Earth
2	Group Division	Class Tools
3	Data retrieval	IoT Surber Net + HP Camera
4	Data collection	Google Spreadsheet
5	Data analysis	Macroinvertebrates Live Gap Chart
6	Documentation of Field Activities	Instagram

Table 1 describes the stages of activities in implementing the field study method along with the technology that can be used to support each stage of learning activities. The technology offered is suitable for application because it is effective in use and relevant to the material being taught, and is not too difficult to use. The integration of technology in the implementation of this field study method is further explained as follows.

1. Location determination and group distribution

   Determining the location and distance in field study activities is assisted by the Google Earth application. This application will help teachers determine a suitable area for observation by considering the distance and travel time to the observation location. With this application, the location determination process can be known earlier without the need to conduct a direct survey in the field. The choice of this location was determined based on the closest distance but has the potential and qualifications to make observations there so that the costs required are less and the travel time is shorter. Through Google Earth, the teacher can also check the conditions around the activity location, for example, whether there are residential areas, factories, etc. that might affect the condition of the river at the observation site.

   The teacher will divide students into 3 groups, each group will be placed in 3 different river areas so that students can compare the results of observations in the three areas (upstream, middle, and downstream of the river). The selection of these three different locations is expected to construct students' knowledge regarding the influence of various factors abiotic and biotic at different locations. Group division is assisted by the Random Team Generator, namely Class Tools. With an online application that can be used for free, it will make it easier for teachers to form fair and heterogeneous student groups.

2. Data collection

   In this learning innovation using the field survey method, students will collect various data which will be indicators of water pollution in the river which is the location of the observations. Parameters will be measured namely physics, chemistry, and biology. Indicator pollution air is divided into three, physics, chemistry, and biology. In physics students will observe the temperature, clarity, conductivity, and color of the water. Chemically can be seen from the pH of water, oxygen content in the air (DO), as well as BOD (Biological Oxygen Demand). Biologically observations were made of the organisms inside water, especially macroinvertebrates. The data obtained by students is collected through Google Spreadsheets that have been prepared by the teacher.

3. Field data retrieval

   Using IoT (Internet of Things) that has been designed, each group takes physical and chemical data on water quality. These IoT-based tools are placed in three different locations, and the data can be connected directly to the applications on students' cell phones. This allows students not to have to come to the observation site every day to take measurements. Field data collection was carried out for seven days (morning, afternoon, and evening) to see differences in observations from day to day. Meanwhile,

biological data were obtained on the first and seventh days of observation using Surber Net. By using this tool, the teacher directs students to collect aquatic organisms in particular macroinvertebrates. The organisms obtained will be further identified by students. Organisms obtained by students can be documented using a cell phone camera so that they can be stored, studied, and further analyzed by students later. During data collection, the teacher monitors student performance at the beginning of the field activity process through Instagram Live which is available on the Instagram application on student cell phones.

4. Data analysis

   Utilizing the LiveGap Chart students can convert data that has been collected into diagrams/graphs. The teacher will later direct students to analyze differences in observation indicators on different days and times. One of the benefits of presenting data in a bar chart makes it easier for students to read data and determine the frequency of data quickly and accurately. Students' quantitative literacy skills will also be trained through this learning process. Besides that, macroinvertebrates as websites that help identify organisms that students have collected at the observation site. This application will assist students in classifying and analyzing groups of organisms that are indicators of pollution air.

5. Field documentation

   Utilization of the Instagram application can directly document student activities in the field. Data obtained from Google Sheets are stored automatically and can be accessed at any time by the teacher for further discussion. Each group can also input their observation data directly on the same link. Thus, this observational data can be continuously updated by students and controlled by the teacher directly.

The use of technology Internet of Things (IoT) in learning, especially environmental change material, really helps students in collecting data. Various studies have been conducted regarding the use of IoT in various sectors (Surahman, 2021; Adani & Salsabil, 2019). In learning biology, a lot of research has also been carried out using IoT in helping biology learning (Jayawardana, & Gita, 2020; Ekayan, 2021). The use of IoT is proven to help in learning and increase student learning motivation. Students only need to use one tool for all the indicators tested and the data is directly connected to the application used. In addition, students can also view data at different times simply by using Android. This is very helpful for students in collecting data and time efficiently. The use of macroinvertebrates helps students identify benthos found in rivers as biological indicators. This innovation also uses the help of Google Earth technology to determine the location of the river and measure the length and width of the river. In addition, the use of the application of charts helps students in making graphs of the results of physics and chemistry indicator data. Making it easier for students to draw conclusions and understand the learning.

This innovation also uses the Instagram application to make it easier for teachers to monitor and document student activities while in the field. Data input was used by Google spreadsheets to make it easier for students to group physics, chemistry, and biology indicator data. Catching benthos as an indicator of clean water using surfnet and HP as identification and photos. The combination of all these technologies will help teachers use field study methods in teaching students. In addition, introducing various technologies to students.

Each technology used must have advantages and disadvantages in using. One of the difficulties that might be found in implementing this learning innovation is the limited internet network, because this learning requires applications such as Instagram requiring an internet network. For this reason, in implementing this innovation, teachers need to think of other alternatives as a solution.

CONCLUSION

Environmental pollution material that is conceptual in nature and still limited in class tends to be boring so it is necessary to innovate in learning. For this reason, the authors have described recommendations for learning methods and approaches by integrating technology as a solution to these problems. Implementation of learning approaches and methods will be more optimal with the support of appropriate technology. The

suggested technology has been adapted to the material being taught and the stages of learning activities designed. The field study method and contextual approach are expected to increase students' understanding of the material while at the same time teaching students concern for the environment. By integrating technology, the application of this learning innovation can be an alternative effective and efficient learning activity in supporting the learning process.

REFERENCES

Aditama, P., D., Nevrita, N., & Erda, M. (2022). *Pengembangan Media Pembelajaran Biologi Berbasis Instagram Sebagai Alternatif Pembelajaran Dalam Jaringan Pada Materi Sistem Peredaran Darah Kelas XI* (Doctoral dissertation, Universitas Maritim Raja Ali Haji).

Agung, F. P., Suyanto, S., & Aminatun, T. (2020). E-Modul gerak refleks berbasis pendekatan kontekstual untuk meningkatkan pemahaman konsep siswa SMA. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *5*(3), 279-289.

Akbar, R. R. A. (2018). *Pengembangan Video Pembelajaran Matematika Berbantuan Media Sosial Instagram sebagai Alternatif Pembelajaran* (Doctoral dissertation, UIN Raden Intan Lampung).

Ardial. *(*2014). *Paradigma dan Model Penelitian Komunikasi*. Jakarta: Bumi Aksara.

Charsky, D., & Ressler, W. (2011). "Games Are Made for Fun": Lessons on the Effects of Concept Maps in the Classroom Use of Computer Games. Computers and Education, 56, 604-615. https://doi.org/10.1016/j.compedu.2010.10.001

Dillon J, Rickinson, Teamey, Morris, Choi, Sanders & Benefleld. 2006. The Value of Outdoor Learning: Evidence from Research in the UK and Elsewhere. School Science Review: 107-112.

Gusti, U. A., & Artha, H. W. (2022). PENGEMBANGAN SMART BACKGAMMON SEBAGAI MEDIA PEMBELAJARAN BERBASIS LITERASI LINGKUNGAN UNTUK PESERTA DIDIK SD/MI. *Jurnal Pendidikan Dompet Dhuafa*, *12*(01), 7-13.

Gusti, U. A., Rismawati, R., Artha, H. W., & Noviandri, N. (2022). Analisis Pengembangan Media Pembelajaran Berbasis Literasi Lingkungan untuk Peserta Didik Sekolah Dasar. *IBERS: Jurnal Pendidikan Indonesia Bermutu*, *1*(1), 1-7.

Hartini, F. (2019). *Pengaruh Pendidikan Lingkungan Masyarakat terhadap Pembentukan Karakter Anak di Kelurahan Pagar Tengah Kecamatan Pendopo Kabupaten Empat Lawang* (Doctoral dissertation, IAIN BENGKULU).

Hasruddin, N., Y., N., dan Rezeqi, S. (2015). Application of Contextual Learning to Improve Critical Thinking Ability of Students in Biology Teaching and Learning Strategies. *International Journal of Learning, Teaching and Educational Research*. 11(3), 109-116.

Ihsani, I., & Santoso, M. B. (2020). Edukasi Sanitasi Lingkungan Dengan Menerapkan Perilaku Hidup Bersih Dan Sehat (Phbs) Pada Kelompok Usia Prasekolah di Taman Asuh Anak Muslim Ar-Ridho Tasikmalaya. *Prosiding Penelitian Dan Pengabdian Kepada Masyarakat*, *6*(3), 289.

Irhami, S. N. (2019). Implementasi pendekatan kontekstual untuk meningkatkan gairah siswa dalam pembelajaran biologi di madrasah aliyah negeri 02 banyumas. *Jurnal Kependidikan*, *7*(1), 30-42.

Jayanti, D., Septiani, J. I., Sayekti, I. C., Prasojo, I., & Yuliana, I. (2021). Pengenalan Game Edukasi sebagai Digital Learning Culture pada Pembelajaran Sekolah Dasar. *Buletin KKN Pendidikan*, *3*(2), 184-193.

Johnson, E. B. (2002). *Contextual Teaching and Learning: What It Is and Why It is Here to Stay.* California: Corwin Press, Inc.

Juliyanti, H., Hendriyani, M. E., & Mahrawi, M. (2022). Development of A Website Based on A Contextual Approach As A Biology Learning Media On The Subconcept Of The Human Sensory System. *Indonesian Journal of Biology Education*, *5*(1), 22-33.

Kriyantono, R. (2006). Teknis Praktis Riset Komunikasi. Prenada Media Grup: Jakarta.

Munandar, H., Sihaloho, M., & Najmah, N. (2022). Penerapan Model Pembelajaran Picture and Student Active (Pasa) Dengan Pendekatan Contextual Teaching and Learning (Ctl) untuk Meningkatkan Hasil Belajar IPA Siswa Kelas VII SMP Nasional. *Jurnal Riset Rumpun Matematika dan Ilmu Pengetahuan Alam (JURRIMIPA)*, *1*(1), 50-55.

Muslich, M. (2007). *Pembelajaran Berbasis Kompetensi dan Kontekstual.* Malang: Bumi Aksara.

Nasucha, Y., Rahmawati, L. E., Silviana, Y., Udin, R., Atitah, S., Astuti, W., & Arfiah, S. (2020). Penguatan Karakter Peduli Lingkungan melalui Program Cinta Lingkungan di MIM Kranggan, Sukoharjo. *Buletin KKN Pendidikan*, *2*(2), 95-99.

Nengsi, S., Zulyetti, D., & Nelvi, M. H. (2021). Pengembangan LKS Biologi Dengan Pendekatan Kontekstual Materi Sistem Ekskresi Siswa Kelas. *Jurnal Edukasi*, *1*(1), 12-28.

Purwantoyo, E. (2013). Penerapan Model Studi Lapangan pada Materi Keanekaragaman Hayati dengan Memanfaatkan Lingkungan Sekolah. *Journal of Biology Education*, *2*(3).

Rohim, A., & Asmana, A. T. (2018). Efektivitas pembelajaran di luar kelas (outdoor learning) dengan pendekatan PMRI pada Materi SPLDV. *Jurnal Pembelajaran Matematika*, *5*(3).

Saputra, H. (2020). *Analisis Kemampuan Berpikir Kreatif Peserta Didik Kelas XII MIPA melalui Model Pembelajaran Project Based Learning berbantu Instagram dalam Pembelajaran Biologi di SMA Negeri 2 Muaro Jambi* (Doctoral dissertation, Universitas Jambi).

Sariningsih, R. (2014). Pendekatan kontekstual untuk meningkatkan kemampuan pemahaman matematis siswa SMP. *Infinity Journal*, *3*(2), 150-163.

Sunaryo, Y. dan Fatimah, A. T. (2019). Pendekatan Kontekstual dengan Scaffolding untuk Meningkatkan Kemampuan Berpikir Kritis Matematis. *JNPM (Jurnal Nasional Pendidikan Matematika).* 3(1), 66-79.

Ulya, I. F., Irawati, R., & Maulana, M. (2016). Peningkatan kemampuan koneksi matematis dan motivasi belajar siswa menggunakan pendekatan kontekstual. *Jurnal Pena Ilmiah*, *1*(1), 121-130.

Veygid, A. (2021). *Pengembangan microblog berbantuan instagram pada materi sel untuk siswa kelas XI IPA di MAN 3 Jember* (Doctoral dissertation, Universitas Islam Negeri Kiai Haji Achmad Siddiq Jember).

Widodo, A. (2021). *Pembelajaran Ilmu Pengetahuan Alam: Dasar-dasar untuk Praktik.* Bandung: UPI Press.

Zakiah dan Sunaryo. (2017). Pembelajaran dengan Pendekatan Kontekstual Berbasis Gaya Kognitif untuk Meningkatkan Self Awareness Siswa. *Jurnal Teori dan Riset MAtematika (TEOREMA)*. 2(1), 11-20.

Zakiah, N. E., Sunaryo, Y., dan Amam, A. (2019). Implementasi Pendekatan Kontekstual pada Model Pembelajaran Berbasis Masalah Berdasarkan Langkah-langkah Polya. *Teorema: Teori dan Riset Matematika*. 4(2), 111-120.