KESEPAKATAN BERSAMA

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FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN

UNIVERSITAS SAMAWA (UNSA)

DENGAN

LEMBAGA PENELITIAN DAN PENGABDIAN KEPADA MASYARAKAT

(LPPM) UNIVERSITAS MANDALIKA MATARAM (UNDIKMA)

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TENTANG

KEGIATAN PENELITIAN DAN PENGABDIAN KEPADA MASYARAKAT

Pada hari ini Selasa Tanggal satu Bulan Februari Tahun Dua Ribu Dua Puluh dua bertempat Fakultas Sains, Teknik dan Terapan (FSTT), Universitas Mandalika Mataram(UNDIKMA) yang bertanda Tangan di bawah ini :

1. **Erma Suryani, S.Pd.,M.Pd**

   :Dekan Fakultas Keguruan dan Ilmu Pendidikan Universitas Samawa (UNSA) berkedudukan di Jalan Raya Sering Sumbawa Besar Nusa Tenggara Barat, yang selanjutnya disebut PIHAK PERTAMA

2. **Dr. Akhmad Sukri, M.Pd**

   :Ketua Lembaga Penelitian dan Pengabdian Kepada Masyarakat (LPPM) Universitas Mandalika (UNDIKMA), yang berkedudukan di jalan Pemuda No. 59 A Mataram, Nusa Tenggara Barat, yang selanjutnya disebut PIHAK KEDUA.

PIHAK KESATU dan PIHAK KEDUA yang selanjutnya disebut PARA PIHAK bersepakat untuk mengadakan kerjasama "**KEGIATAN PENELITIAN DAN PENGABDIAN KEPADA MASYARAKAT "** dengan ketentuan sebagai berikut :

DASAR HUKUM :

1. Undang-Undang Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional
2. Peraturan Menteri Pendidikan dan Kebudayaan Nomor 46 Tahun 2019 tentang Kerjasama perguruan tinggi dalam bingkai kampus merdeka.
3. Peraturan Pemerintah Nomor 19 Tahun 2005 tentang Standar Nasional Penyelenggaraan Pendidikan.
4. Peraturan Pemerintah Nomor 30 Tahun 1990 tentang Pendidikan Tinggi
5. Surat Keputusan Bersama (SKB) 4 Menteri yaitu Mendikbud, Kemenag, 516 Menteri Kesehatan dan Menteri Dalam Negeri Nomor : 01/KB/2020, Nomor : Tahun 2020, Nomor HK.03.01/Menkes/363/2020 dan Nomor : 440-882 tanggal 15 Juni 2020 Tentang Panduan Penyelenggaraan Pembelajaran pada Tahun Ajaran 2020/2021 dimasa Pandemik Corona Virus Desiase 2019 (COVID-19).
6. Peraturan Pemerintah Nomor 50 Tahun 2007 tentang Tata Cara Pelaksanaan Kerjasama Daerah.

BAB I
MAKSUD DAN TUJUAN KERJASAMA
Pasal 1

1) Maksud kerjasama adalah untuk menjalin dan membina hubungan kelembagaan antara PIHAK PERTAMA dengan PIHAK KEDUA dalam peningkatan kerjasama kolaborasi antar perguruan tinggi.
2) Menjalin kerjasama dalam bidang Penelitian dan Pengabdian Masyarakat serta Pengembangan Sumber Daya antar perguruan tinggi)

BAB II
OBYEK KERJASAMA
Pasal 2

1. Karjasama bidang penelitian dan pengabdian masyarakat dan pengembangan Sumberdaya antara Fakultas Keguruan dan Ilmu Pendiidkan (FKIP) Universitas Samawa dan Lembaga Penelitian dan Pengabdian Kepada Masyarakat Universitas Mandalika Mataram (UNDIKMA).
2. Kerjasama untuk mendukung program Merdeka Belajar-Kampus Merdeka (MBKM) yang meliputi Magang/praktik kerja, Penelitian/riset, proyek

kemanusiaan, Studi/proyek independen, kegiatan wirausaha dan membangun desa atau kuliah kerja nyata tematik yang didukung dunia usaha.

BAB III
RUANG LINGGKUP KERJASAMA

1) Ruang lingkup kesepakatan bersama ini meliputi aspek Penelitian dan Pengabdian kepada masyarakat
2) Rincian kegiatan sebagai berikut :
   a. Penelitian
   b. Pengabdian Masyarakat
   c. Kegiatan lain yang disepakati kedua pihak

BAB IV
BENTUK KERJASAMA
Pasal 4

1) Pelaksanaan kesepakatan bersama akan dirumuskan lebih lanjut secara lebih rinci dalam bentuk Perjanjian Kerjasama bersifat khusus yang disepakati oleh PARA PIHAK, yang mana perjanjian tersebut merupakan bagian yang tidak terpisahkan dari kesepakatan bersama ini.
2) Pelaksanaan perjanjian kerja sama akan dikoordinasikan lebih lanjut sesuai dengan kebutuhan PARA PIHAK.

BAB V
HAK DAN KEWAJIBAN
Pasal 5

1) PIHAK PERTAMA, menjamin kesiapan data dan informasi serta menjamin terselenggaranya kegiatan pendidikan dan pengajaran, penelitian dan pengabdian kepada masyarakat di FKIP Universitas Samawa.
2) PIHAK KEDUA, Menjamin terselenggaranya kegiatan penelitian dan pengabdian kepda masyarakat serta mendukung terlaksanannya beberapa poin terkait program Merdeka Belajar Kampus Merdeka (MBKM).

BAB VI

JANGKA WAKTU

Pasal 6

Kesepakatan bersama ini berlaku untuk jangka waktu 3 tahun terhitung mulai tanggal ditanda tangani dan dapat diperpanjang berdasarkan kesepakatan PARA PIHAK.

BAB VII

PERUBAHAN / PENAMBAHAN

Pasal 7

Setiap perubahan dan atau penambahan pada perjanjian kerjasama ini dinyatakan sah berlaku apabila dibuat secara tertulis dalam suatu aturan tambahan yang ditanda tangani oleh PARA PIHAK dan merupakan bagian yang tak terpisahkan dari perjanjian kerjasama ini.

BAB VIII

PENUTUP

Pasal 8

Kesepakatan bersama ini dibuat dan ditanda tangani oleh PARA PIHAK pada hari, tanggal, bulan dan tahun sebagaimana disebut pada awal kesepakatan bersama ini dalam 2 (dua) rangkap asli, bermaterai dan memiliki kekuatan hukum yang sama untuk dipergunakan sebagaimana mestinya.

PIHAK PERTAMA	**PIHAK KEDUA**
Dekan FKIP UNSA	Ketua LPPM UNDIKMA
Erma Suryani, S.Pd.,M.Pd	**Dr. Akhmad Sukri, M.Pd**

GUIDED INQUIRY MODEL THROUGH VIRTUAL LABORATORY TO ENHANCE STUDENTS' SCIENCE PROCESS SKILLS ON HEAT CONCEPT

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Abstract: Science process skills are one of the indicators to know the level of achievement of physics teaching goals. This research examines the influence of guided inquiry models through virtual laboratories on students' science process skills. The research was a quasi-experiment conducted at the senior high school in Mataram, Lombok. The samples were class XI students, as many as 58 people divided into two sample groups: experimental and control groups. The guided inquiry model through the virtual laboratory was applied to the experimental group and the conventional model for the control group. The instrument used was a performance sheet. A t-test was used to analyze the effect of learning model on science process skill. The results of this study found that the achievement of science process skills for the experimental group was higher than the control group. The guided inquiry models through virtual laboratory have a significant effect on science process skills, especially on skills: hypothesizing, practicing, and communicating. These findings contribute significantly to the current knowledge about the effectiveness of guided inquiry models through virtual laboratories to improve students' science process skills in physics teaching.

Keywords: ***guided inquiry, virtual laboratory, science process skills, heat concepts***

MODEL INKUIRI TERBIMBING MELALUI LABORATORIUM VIRTUAL UNTUK MENINGKATKAN KETERAMPILAN PROSES SAINS SISWA PADA KONSEP KALOR

Abstrak: Keterampilan proses sains adalah salah satu indikator untuk mengetahui tingkat pencapaian tujuan pembelajaran fisika. Penelitian ini menguji pengaruh model inkuiri terbimbing melalui laboratorium virtual pada keterampilan proses sains siswa. Penelitian ini termasuk eksperimen semu yang dilakukan di Sekolah Menengah Atas di Mataram, Lombok. Sampel adalah siswa kelas XI sebanyak 58 orang yang dibagi menjadi dua kelompok sampel: kelompok eksperimen dan kontrol. Model inkuiri terbimbing melalui laboratorium virtual digunakan pada kelompok eksperimen dan model tradisional untuk kelompok kontrol. Instrumen yang digunakan adalah lembar kinerja. Uji beda t-tes digunakan untuk menganalisis pengaruh model pembelajaran terhadap keterampilan proses sains. Hasil penelitian ini menemukan bahwa pencapaian keterampilan proses sains untuk kelompok eksperimen lebih tinggi dibanding kelompok kontrol. Model inkuiri terbimbing melalui laboratorium virtual memiliki pengaruh yang signifikan pada keterampilan proses sains terutama pada keterampilan: berhipotesis, praktikum, dan berkomunikasi. Temuan ini berkontribusi signifikan terhadap pengetahuan saat ini tentang efektivitas model inkuiri terbimbing melalui laboratorium virtual untuk meningkatkan keterampilan proses sains siswa dalam pembelajaran fisika.

Kata Kunci: ***inkuiri terbimbing, laboratorium virtual, keterampilan proses sains, konsep kalor***

INTRODUCTION

The essence of science is not only about the content but the process as well. Physics is a part of science that is closely related to how to analyze the natural phenomena systematically. Some physics concepts which are abstract concepts often become obstacles for teachers to convey and visualize concepts to students. Therefore, the teaching of physics is not only a collection of knowledge such as facts, concepts, or principles but is a process of discovery. Consequently, life skills are indispensable in social life to adapt and deal with the challenges of everyday life well. The development of life skills can be done by teachers at school (Khera & Khosla, 2012).

The purpose of physics teaching is to develop students' experiences in formulating problems, testing hypotheses through experiments, designing and assembling experimental instruments, collecting, processing and interpreting data, and communicating experimental results both orally and in writing. In addition, physics is taught so that students understand the concept well. Understanding good physics concepts can be a reference for students to solve various problems and interpret physics concepts. Therefore, an inquiry-based learning model or emphasis on student-centered skills and learning is needed (Crouch & Mazur, 2001; Smith, Wood, Adams, Wieman, Knight, Guild, & Su, 2009; Tien, Roth, & Kampmeier, 2002). Additionally, Sheffield, & McIlvenny (2014) stated that the inquiry could improve students' knowledge and confidence in the skills and processes related to questions and concepts of science.

The inquiry is a process for obtaining information. The information comes from the process of observation or experiment to find answers and solve problems using critical and logical thinking skills. The inquiry learning model provides more opportunities for students to learn directly. In addition, students have the opportunity to practice developing process skills, thinking skills, and being scientific (Jufri, 2013). Inquiry-based learning aims to encourage students to be more creative in imagining. The process of imagination in this model is organized and appreciated as a form of natural curiosity. Therefore, they are encouraged not only to understand the subject matter but also to create an invention. Furthermore, students are not only within the scope of discussing science learning but also encouraged to do science (Anam, 2015).

In principle, the purpose of inquiry learning helps students in formulating questions, seeking answers or solving to satisfy their curiosity, and helping to understand a theory or an idea of what is learned. Based on teacher guidance of students, the inquiry learning model was divided into three types: free inquiry, modified free inquiry, and guided inquiry. This study chooses guided inquiry model based on feedback from physics teacher that the students are still difficult to conduct an independent investigation, so still need teacher guidance.

Learning with a guided inquiry model involves students in finding and using various sources of information to improve their understanding of the concepts learned. Students not only answer questions and get correct answers but also involve interest and challenge students to connect their world with inquiry (Kuhlthau, Maniotes, & Caspari, 2015). Students are required to find concepts through instructions from teachers. Teachers as mentors in the learning process need to support low-ability students to learn well. As a result, highly skilled students do not monopolize learning.

This model is suitable to be applied in physics teaching. Furthermore, the syntax of the model can develop basic science skills that include: observing, classifying, computing, formulating hypotheses, designing experiments, measuring, collecting data, interpreting data, drawing conclusions, and communicating.

The skills of activities that have been described are known as skills in the process of science. Scientific process skills typically refer to skills the students possess such as scientists in the scientific discovery process. Scientific process skills are behaviours that encourage skills to acquire knowledge. In addition, disseminate such knowledge to improve mental and psychomotor skills optimally. Based on research by Turiman, Omar, Daud, & Osman (2012), science process skills can train students in the process of thinking and scientific attitudes. The process of learning and teaching science process skills is a process designed in such a way that students understand facts, concepts, and relate them to the science process skill theories and the students' attitudes themselves. These skills are divided into two groups. First, basic science process skills include the process of observing, asking questions, classifying, measuring, and predicting. Second, integrated science process skills include: the process of identifying and defining variables, collecting and transforming data, creating data tables and graphs, describing the relationships between variables, interpreting data, manipulating materials, recording data, formulating hypotheses, designing investigations, summarizing and generalizing (Karamustafaoðlu, 2011). The basic skills of science can be applied through practicum activities.

The capabilities developed in the practicum should be student-oriented and product-oriented

(Odubunmi & Balogun, 1991). Therefore, learning through practicum should be clear about the specific scientific formulae that are rational and adapted to what the student needs. Odubunmi & Balogun (1991) define the general and specific goals that should be achieved in the practicum: solving problems, using knowledge and skills in unusual situations, designing simple experiments to test hypotheses, using laboratory skills to present simple experiments, interpreting data, and providing rules about experiments.

Scientific process skills are one of the most important basic science skills of the 21st century. However, these skills are not supported by facilities to develop such as the availability of tools and practicum materials. The facility is still limited because it is quite expensive. An experiment in science requires tools and materials. Successful experiments are dependent on the ability to choose and use the right tools effectively. Using tools and materials is an experience that students need to make new ideas. This is an essential requirement for students who are still at the concrete operational level.

Practicum activities take a long time. Meanwhile, the utilization of tools and laboratory materials in the laboratory is still not effective. There are some problematic physical materials to be practiced or visualized using real tools and materials. As a result, students' skills are low and not developed. The solution is through the use of virtual media such as a virtual laboratory. This media is widely available on the internet and the results of previous researchers. The use of computer technology is also proven beneficiary in improving learners' critical thinking skill (Rajagukguk & Simanjuntak, 2015), verbal and figural creativities (Hamlen, 2009), improve the concept mastery of the student (Herayanti, Fuadunnazmi, & Habibi, 2017), and learners ability to solve problems (Serin, 2011).

Çelik, Sarý, & Harwanto (2015) also stated that the use of a simulation program has an advantage in explaining the experiment to increase the students' understanding of physics, providing good visualization, easy to operate, enhance the students' creativity, making physics easier, representing the physical phenomena in visual program, entertaining and useful for fluid simulation. Simulations in virtual laboratories could train students' thinking skills in developing ideas by combining image patterns and verbal communication in solving problems.

Currently, the role of teachers is limited as a facilitator or regulator in the classroom. With multimedia, students can repeat every learning material until they understand it naturally (Muslem & Abbas, 2017). The virtual laboratory as a teaching media is an essential component of the learning system. Virtual learning is one of the ways for teachers to interact with students. Microscopic and macroscopic phenomena can be described on a certain scale through simulations so that they can be observed by students (Arista & Kuswanto, 2018).

Previous researchers have suggested that the virtual laboratory is a tool to improve teacher quality by providing virtual devices, algorithms, and other devices within a specific scope. The goal is to develop problem-solving skills and control themselves according to their professional needs in the future. Jaya (2012) defines a virtual laboratory as an interactive environment for creating and conducting simulation experiments: a playground for experimenting. It consists of domain dependent simulation programs, experimental units, tools to operate the objects, and reference books. As a result, researchers combine guided inquiry models with a virtual laboratory to develop students' science process skills.

Previous research has suggested that the application of guided inquiry learning models through simulation media significantly influences primary students' science skills (Hayati, Hikmawati, & Wahyudi, 2017). In addition, the inquiry model proved to improve student learning (Schneider, Krajcik, Marx, & Soloway, 2002; Von-Secker & Lissitz, 1999).

The combination of the guided inquiry model and virtual laboratory is still rarely done, especially if it is associated with students' science process skills. In addition, the effectiveness of this learning model for science process skills requires a better understanding, supported by detailed data and discussion. Thus, a clearer study is needed to explain the importance of using guided inquiry learning models through virtual laboratories, to mastering students' science process skills. The importance of a clear understanding of the use of this model will be a benchmark for technological-based learning innovations.

The benefits provided by this study include a better understanding of guided inquiry learning models if supported by media such as virtual laboratories. Other benefits such as can be used as an alternative learning model for teachers in developing better science learning, especially physics. The results of the study can be used as a reflection to make innovations and renewal of learning models in order to improve the quality of learning physics. The main thing is to provide actual research data in the application of technology in learning, especially in improving students' science process skills.

The purpose of this study was to examine the effect of applying the guided inquiry model through a virtual laboratory to students' science process skills on the concept of heat. The analysis was carried out on each indicator of the science process skills tested.

METHODS

This research was a quasi-experiment to determine the effect of treatment on dependent variables under controlled conditions (Creswell & Creswell, 2017). The research was conducted in senior high school at Mataram, West Nusa Tenggara. The research population was all students of class XI of natural sciences as many as 148 students. The sampling technique was cluster-random sampling. Respondents were 58 people divided into two groups: experiment and control. In the experimental class had been taught using a guided inquiry model assisted by a virtual laboratory while in the control class taught with conventional learning, which was cooperative learning. The data of science process skills were collected during the learning process, which used student performance appraisal instruments. The study was conducted from September 2016 to March 2018. Scientific process skills were intended for students' basic science skills such as skills in formulating problems, hypothesizing, practicing, summarizing, and communicating. The five indicators of science process skills were used as the basis for developing research instruments. So that the score produced by the research subject will explain the strength of their science process skills. Scoring techniques are based on classical completeness techniques on a scale of 0 to 100. The data obtained must be normally and homogeneously distributed as a pre-requisite for being analyzed using the t-test to determine the effect of guided inquiry model through the virtual laboratory to science process skills.

FINDINGS

In this study, guided inquiry model through virtual lab was used to improve students' science process skill. The data from the result was homogenous and normal, which showed in Table 1.

Based on the analysis result in Table 1, the science process skill data meets the prerequisites for analysis. The t-test at a significant level of 0.05 was used to determine the difference of guided inquiry model through the virtual laboratory and the conventional learning to science process skills at experiment class and control class. Recapitulation of test results is presented in Table 2.

Table 2 gives the results which show that the scores for the model differences used are F = 18.556 with a significance of 0.000 < 0.05. It means that there was a significant difference in the skills of the science process between the

Table 1. Normality and Homogeneity Test for Science Process Skills

Analysis	Science Process Skills
N	58
Significance level	0.05
Normality	0.473
Decision	0.473 > 0.05, Normally distributed
Homogeneity	0.084
Decision	0.084 > 0.05, Homogeneous variant

Table 2. Hypothesis Testing on Science Process Skills

Source	Sum of Square Type III	The Average Squared	F	Sig.
Models	1198.689	1198.689	18.556	p < 0.001

Table 3. The Comparison of Student Science Process Skills

Groups	Average	The Highest Score	The Lowest Score
Experimental	87,72	98,00	70,00
Control	77,93	95,00	65,00

Table 4. Hypothesis Testing on Each Indicator of Science Process Skills

Anova Test	Mann-Whitney U Test			
Formulating Problems	Hypothesizing	Practicing	Concluding	Communicating
F = .047	Z = -2.897	Z = -5.982	Z = -1.319	Z = -4.182
Sig.	Sig.			
.830	.004	.000	.187	.000

experimental and control groups. The significant difference was supported by the average score of the experimental group that is higher than the control group, which showed in Table 3.

Indicators of the experimental and control groups are presented in Figure 1.

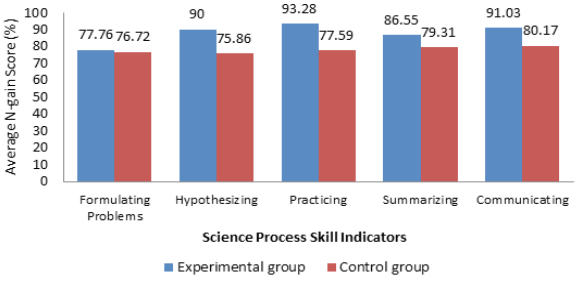

Figure 1. Comparison of Students' Science Process Skills on Each Indicator

The average score of the experimental and control group was similar in the first indicator: formulating the problem. For the other indicators, the scores were slightly higher on the experimental group than the control group. Hypothesis testing has been done for each indicator to know the significant difference of the score, and the result was showed in Table 4.

Data on the influence of guided inquiry model through the virtual laboratory on each indicator of the science process skills are presented in Table 4. The result showed that the first indicator of science process skill (formulating problem) had no significant difference score between the experiment and control group. Therefore, the findings indicated that the students' science process skills on indicators formulate problems almost the same in both groups. This result is supported by Mutlu & Sesen (2016), who found that virtual media did not affect to improve teacher skill in formulating the problem.

Based on Table 4, the Z value of the indicator making the hypothesis is -2.897 at a significant level of 0.004 < 0.05. The average value for the experimental group was higher than the control. These results indicated that the guided inquiry model through the virtual laboratory has significantly influenced the students' skill in making hypotheses. Özgelen (2012) stated that making hypotheses or making statements about possible relationships is another essential skill based on accurate observations and conclusions. Interpreting data involves other process skills such as predicting, concluding, and hypothesizing the data collected. Students should have the experience to observe, classify, and measure before interpreting the data. The experiment involves all basic and integrated processes such as observing for the identification of variables, developing operational definitions, building and conducting tests, collecting and interpreting data, and modifying hypotheses.

On indicators of practicing and communicating based on Mann-Whitney U, test results obtained Z values were: -5.982 and -4.182 on the significance of 0.000 < 0.05. Therefore, there are significant differences for indicators of 'practicing and communicating between experimental and control groups. The experiment group average is higher than the control. Guided inquiry models through virtual laboratories exert a significant effect on students' science process skills for practicing and communicating indicators.

The fifth science process skill indicators, namely summarizing has no significant difference

between experimental and control group. This result was proved by Mann-Whitney U test results, which shows the value of Z = -1.319 at the level of significance of 0.187 > 0.05. Although the average score of the experimental group was higher than the control group, statistically, the differences in the two groups were not significantly different.

DISCUSSION

Table 3 shows that students' science process skill was different for each group. The experimental group has a higher average score than the control group. This difference proves that guided inquiry model through a virtual lab can improve students' science process skill. Gormally, Brickman, Hallar, & Armstrong (2009) found that the inquiry learning model through laboratories was better than the conventional model to improve students' science process skills. The students' scientific process skills are more effectively enhanced through virtual media, (Yang & Heh, 2007; Mutlu & Sesen, 2016) than the traditional laboratory. There was a difference in student activity before and after treatment in the application of guided inquiry model through a virtual laboratory. The guided inquiry learning model through the applied virtual laboratory has been able to prepare the students in situations to conduct experiments independently with teacher guidance. This learning model consists of learning stages to guide students through a series of scientific inquiries. Students become active in the learning process. However, in the conventional learning model, the application is tailored to the tools and laboratory that have been provided. As a result, students become passive in learning. Student activity during learning is mostly just sitting and listening to the teacher. Osman & Vebrianto (2013) stated that learning with ICT can develop science process skills and simultaneously enhance the students' learning achievement. Ketpichainarong, Panijpan, & Ruenwongsa (2010) stated that students' achievement in acquiring knowledge and science process skills was higher through inquiry laboratory than the traditional style. Mashami & Gunawan (2018) stated that the results of experiments using computer simulation could improve students' critical thinking skills compared to students who do not use dynamic visualization elements in the classroom. These findings are supported by research by Minderhout & Loertscher (2007), who developed a learning-oriented guided learning process that enhanced content knowledge and student skills. The guided inquiry learning model through virtual laboratory is a student-oriented model. This model has learning stages that are used for training students' science process skills. The guided inquiry step is structured systematically and completely making the students active in the learning process. This study shows that students have the opportunity to improve the science process skills through investigation activities such as observation, formulating problems, hypnotizing, collecting data, testing hypotheses, and concluding. Each guided inquiry stage teaches students about the skills of the science process. The teacher prepares this learning model. The teacher guides the students to find and investigate the problem.

The control group was treated using a conventional learning model. Cooperative learning through the real experiment is used in the control class. Cooperative learning also has a good effect on improving students' science process skills in accordance with the research conducted by Bilgin (2006). However, students cannot control their learning time better. This is because the experimental process in the laboratory has high complexity. In addition to dealing with tools and long experimental methods, students are required to work together in groups, and many students perform other activities during the learning process such as talking to their friends, daydreaming and sleeping.

Furthermore, students in laboratory activities, run out of time in conducting experiments and could not complete all the procedures in it. As a result, it will impact on their lack of science process skills. This is the difference between the guided inquiry and conventional models. The advantage of guided inquiry through the use of virtual laboratories is to influence the skills of the science process. Olympiou & Zacharia (2012) stated that the combination of real virtual laboratory aims to solidify the concepts obtained from real environments to be easily applied without losing the students' scientific process skills. The use of computer animation in virtual laboratories is useful for improving students' motivation and their desire to participate in laboratory activities (Karagöz & Özdener, 2010).

Overall, the guided inquiry model through the virtual laboratory does not have a significant effect on the skill indicators formulating the problem and making conclusions, while this model exerted a significant effect on hypothesizing, practicing, and communicating skills. According to Cahyani, Rustaman, Arifin, & Hendriani (2014), multimedia-assisted inquiry learning can improve the attitude of curiosity, cooperation, creativity, and environmental awareness. The students' scientific ability, especially on conclusion capability and communicating ability, is higher than other indicators. Ismail, Permanasari, & Setiawan, (2016) have found that the implementation of STEM-based virtual lab proved to improve student's scientific literacy. Prihatiningtyas, Prastowo, & Jatmiko (2013) also found that the use of computer simulations and simple kits in physics teaching can help students complete learning outcomes on psychomotor aspects.

The students' science process skills were measured through a performance by applying the scientific methods presented in the student worksheet which include: creating goals, formulating the problem, hypothesizing, practicing, and communicating. The results of this study indicate that the group of students in the experimental group was better than the control in formulating the problem, which showed in Figure 1. However, the value of the experimental and control groups did not differ significantly. This is because there is no variation in the presentation of activity objectives as the basis of the students to make the problem formulation.

On the other hand, there were significant differences in the second indicators, namely hypothesizing. The model applied to the learning process is the activity of making the hypothesis. Nevertheless, the average value of the experimental group was higher than the controls on this indicator. The superiority of the experimental group in making the hypothesis is supported by the students' ability to formulate the problem. Students used the hypothesis to answer the problem formulation as a temporary answer before the practicum to test the hypothesis.

Meanwhile, the control group made the hypothesis not based on the formulation of the problems that have been prepared. As a result, the hypothesis is not to answer the problem formulation. In the data collection process, the experimental group was better than the control. Based on the results of the analysis of the practical skills, the experimental group was significantly different from the control group. The highest value of the experimental group is on the practicum indicator. The cause is a student skill formed through direct interaction with the virtual laboratory repeatedly to find the answer to the problem. It can train students in understanding the concept. Gunawan, Suranti, Nisrina, Herayanti, & Rahmatiah (2018) have found that the use of virtual laboratory can help improve students' creativity in numerical, verbal, and figural aspects. Students' creativity in learning helps them to master the concept of physics better. This finding supports a study by Gunawan & Liliasari (2012) reported that the computer technology is also proven beneficiary in improving learners' critical thinking disposition, specifically on two critical thinking disposition indicators, which is truth-seeking and open-mindedness.

The experimental group was also better than the control in interpreting the data. The process of interpreting the data ends in a decision to conclude. This has been proven by the average score of the experimental group, which is higher than the control. However, the difference is not significant. There is no specific difference in skill-making conclusions between the experimental and control groups. The students' science process skills in communicating between the experimental and control groups differed significantly. The average score of the experimental group is higher than the control group. The advantage of the experimental group, in this case, is the ability to connect each stage that has been prepared.

CONCLUSION

The results of this study concluded that the guided inquiry model through the virtual laboratory has a significant effect on the students' science process skills. The average science process skills of the experimental group students were higher than the control groups in each indicator. In indicators hypothesizing, practicing, and communicating, abilities in both groups differed significantly. Whereas, the ability of both groups is almost the same on two indicators, namely formulating the problem and making conclusions.

The findings of this study contribute to the development of the science of education, especially those related to the development of thinking skills and science process skills through learning assisted by computer technology. In further research, it is recommended that there be a measurement of the effectiveness of the inquiry model with virtual laboratories for 21st-century thinking skills.

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Using Virtual Laboratory to Improve Pre-service Physics Teachers' Creativity and Problem-Solving Skills on Thermodynamics Concept

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Abstract. Virtual laboratories have been developed in this study as an alternative to the limited equipment of physics experiments. This study aims to examine the effectiveness of virtual lab models to improve creativity and problem-solving skills for prospective physics teachers. The research and development have been divided into 3 phases namely, preliminary study, design development, and model testing. Model testing was performed on two groups of thermodynamic courses using a pre-test post-test control group design. The instruments that have been used are creativity tests and problem-solving tests in the form of essays. Instruments of creativity include verbal and figural aspects. Each data was analyzed using t-test and normalized gain score. The results showed that there was an increase in creativity and problem-solving skills in both groups. The creativity of students of the experimental group was higher than the control group. Student problem-solving skills in the two groups differed significantly. The experimental group has a higher problem-solving ability than the control group. This suggested that the developed virtual lab model proved to improve the creativity and problem-solving skills ability of prospective physics teachers.

1. Introduction

Physics is a part of science that consists of facts, concepts, principles, and laws that are verified through a set of experimental activities and quantitative measurements. One of the goals of physics learning is to develop theories to create technology that is capable of assisting human life. Thus, learning physics plays an essential role in educating, cultivating, and developing the potential of learners to become qualified human resources. Afrizon et al. [1] stated that physics learning had contributed a lot to the development of science and technology. Most of the technology used by humans today based on the development of theories of physics.

One of the branches of physics is thermodynamics. Thermodynamics consists of abstract concepts that learn about the relationship between energy and work of a system. Thermodynamics also studies the macroscopic quantities of systems that can be observed and measured in experiments. Microscopic quantities of thermodynamics can be studied in the gases kinetic theory. The concept and theory of thermodynamics have developed many industrial and technological systems in the world. Without

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studying thermodynamics well, maybe at this moment, we cannot enjoy the advanced technology that helps our lives.

Learning on thermodynamic concepts needs to be supported by adequate experimental activities to examine the truth and to develop the thermodynamic theories. Experimental activities provide an opportunity for learners to discover their concepts through observation with thinking skills, creativity, and problem-solving skills. Currently, the implementation of experimental activities encountered many obstacles such as laboratory facilities, and infrastructure does not support the experimental activities. In addition, some experimental activities also require a high cost and take a long time to experiment with results as expected. This problem then becomes the main reason why experimental activities are not conducted by educators, thus implicating the low creativity and problem-solving skills of students.

Some of these problems can be solved by developing innovative learning media. The use of supporting media can make learning more productive and able to simplify complex concepts. Many media can be used in physics learning, especially in thermodynamics course. Currently, computer-based media is considered the most appropriate to use. Computer-based media can make students get unlimited information. One of the computer-based media that can support the experimental activity is a virtual laboratory.

A virtual laboratory developed and used to perform experimental activities just like a real laboratory. The virtual laboratory can display text, sound, graphics, video, and animation in an interactive view oriented toward solving real-world problems. Interactive animation such as sub-microscopic media could help students to understand the abstract concept [2]. The virtual laboratory is more accessible for learners to review specific sections and explore ideas more deeply in experimental activities [3]. Experiment activity with virtual laboratory also offers efficiency and help students to experiment repeatedly [4] as well as in real laboratories [5].

One of the aims of learning is to improve students' learning achievement. The current learning process is expected to improve student learning outcomes such as creativity and problem-solving abilities. Problem solving and creativity are essential skills, especially in technology development. Creativity and problem-solving skills are high-level thinking skills that learners need to have to compete in the global competition. Creativity is the ability to discover new things but still in rational ideas. Creativity can help us to do things better. Therefore, everyone needs to act creatively. According to Jackson et al. [6], creativity was defined as a mental process involving the generation of new ideas and new concepts, or new associations between ideas or concepts. From a scientific point of view, the product of creative thinking is usually considered to have originality and conformity. Kandiko [7] reported that creativity is a spontaneous but rational individual action.

In addition to creativity, problem-solving skills are also the most necessary capabilities for the advancement of the younger generation. A person with a reasonable level of problem-solving ability will be able to process information more effectively for his life. Coşkun et al. [8] stated that people who have excellent problem-solving skills could have a better life than others because they are more successful in finding the best solution and knowing how to behave in a problem situation. According to Al-khatib [9], creative thinking ability, especially creative problem solving is essential because it can help someone to face technological change and interact in the globalization era.

Innovation learning media such as virtual laboratory is expected to improve student learning outcomes. Several studies about the use of virtual laboratories have shown a positive impact on learning outcomes. Gunawan et al. [10] revealed that the use of virtual laboratory media could improve the students' conceptual understanding in three different schools. According to Oidov et al. [11], a virtual laboratory contributes to learning, which motivates learners in activities to discover new things so that the learning results also increased. According to Gunawan et al. [12], a virtual laboratory can improve the problem-solving ability of students on the electricity concept. Tüysüz [13] revealed that the use of virtual laboratories could have a positive impact on student learning achievement. Therefore, this study aims to examine the model of the thermodynamic virtual laboratory that has been developed in improving the creativity and problem-solving skills of the pre-service physics teachers.

2. Methods

This research includes development research with three stages namely preliminary study, design development, and testing model. In this research has developed a virtual laboratory for thermodynamics course. Model testing was performed on two groups of students of FKIP Universitas Mataram who were following the thermodynamics course by using a pre-test post-test control group design. The sample was chosen by purposive sampling. The experimental group was treated with the use of virtual laboratory learning model while the control group with conventional learning. The instrument used is the essay test both for creativity and problem-solving ability. The experts have validated the instruments. Creativity instruments include verbal and figural aspects. Each data was analyzed using the t-test. Improved problem-solving skills and prospective physics teacher creativity have been measured using the N-gain formula. N-gain has been used to avoid misinterpretation of increasing scores of each prospective teacher.

3. Results and Discussion

This research used a virtual laboratory to enhance the creativity and problem-solving skills of pre-service physics teachers on thermodynamics course. Creativity and problem-solving skill are part of the high order thinking skill that became the primary goal of education in this century. In this study used experimental groups and control groups to examine the effect of the use of virtual laboratories. The experimental group was treated in the use of virtual laboratory while the control group was treated in the conventional learning. Before treatment, both groups of samples were given pre-test of thermodynamic course. The results showed that both groups have the same ability. After treatment, both groups were given a final test to determine the effect of the thermodynamic virtual laboratory. Furthermore, to reduce misinterpretation of student creativity improvement, N-gain test is also performed. Hypothesis test results on creativity data of both groups are shown in Table 1.

Table 1. Hypothesis Test Results of Creativity in Both Sample Groups.

Mann-Witney	Sig.	Interpretation
Pre-test	.163	There was no initial creativity difference between the two sample groups
Post-test	.036	There was a final creativity difference between the two sample groups
Verbal N-gain	.111	There was no difference in N-gain of verbal creativity between the two sample groups
Figural N-gain	.993	There was no difference in N-gain of figural creativity between the two sample groups
Total N-gain	.167	There was no difference in N-gain creativity between the two sample groups

Based on the data in Table 1, statistically, pre-test data showed that there was no initial creativity difference between the two groups. This means that the level of creativity that students have in both groups is the same. In the post-test, there was a creativity difference between the two groups, in which the experimental group scored higher than the control group. The improvement of creativity of experimental group and control group was not significantly different. Nevertheless, it can conclude that the virtual laboratory used is better enough to develop students' creativity. The results of the study, Gunawan et al. [14] reported that virtual physics laboratories used in cooperative learning could enhance students' creativity, especially on fluency and elaboration indicators. The increase of verbal and figural creativity in both groups was not statistically significant. Comparison of N-gain verbal, N-gain figural, and total N-gain between experimental and control groups are shown in Figure 1.

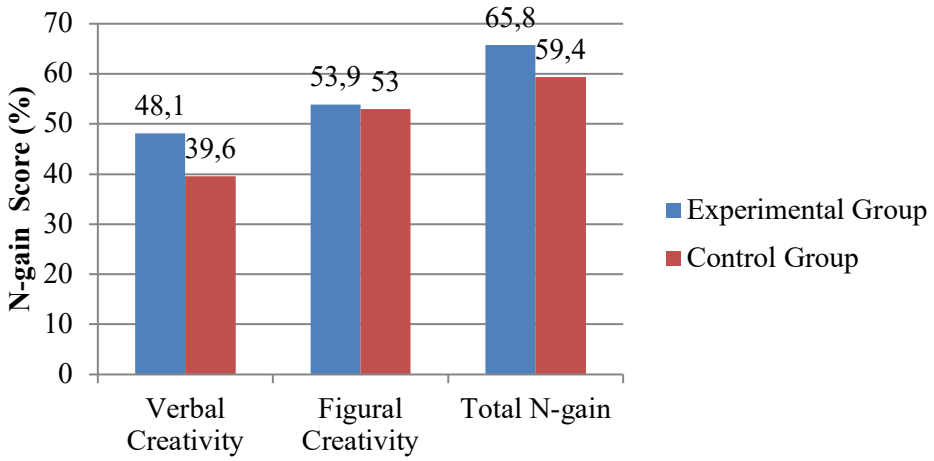

Figure 1. Comparison of Verbal and Figural Creativity in Both Sample Groups

Based on Figure 1 it can be seen that the verbal N-gain of the experimental group is higher than the control group. Therefore, students who have learning with virtual laboratory has sufficiently able to associate their ideas through verbal communication. For the improvement of figural creativity, the experimental and control groups had relatively similar improvements, classified as in the medium category. The data shows that both groups have the same ability to pour ideas through graphs, images, and patterns.

In the experimental group, the acquisition of increased verbal creativity was lower than figural creativity, i.e., 48.1% for verbal creativity and 53.9% for figural creativity. The data showed that the ability of students in pouring ideas through pictures or graphics are better than through verbal communication. Some of the things that are assumed to be the cause of this acquisition are as follows. The virtual laboratory used in this study consist of symbols and images. Also, thermodynamic materials also emphasize much on the graphics that students must understand. The figural creativity of students is better because of this habituation. Students ability to create ideas through graphics and images to be higher than pouring their ideas in verbal. In another study, Gunawan et al. [15] revealed that the project-based learning model with virtual media could improve students' thinking skills in aspects related to fluency, flexibility, and originality rather than ideas associated with patterns or images. In addition, Gunawan et al. [16] stated that virtual laboratories could help students develop their thinking skills by combining ideas verbally. It caused the improvement of verbal creativity was higher than figural creativity.

The use of virtual laboratories in this study has had a positive impact on students' thermodynamic learning. The use of virtual laboratories in thermodynamic learning has been proven to help students overcome the difficulties they face in learning and improve their creativity. For example, the difficulty of graphics can be overcome by visualizing graphs and physical variables, such as isobaric, isochoric, isothermic, and adiabatic graphics. Some of the interactive simulations contained in this model also give students an excellent opportunity to learn to make estimates and try to prove for themselves the truth of their estimates. This condition causes students' figural creativity to be higher than verbal creativity. According to Gunawan et al. [17], a laboratory used in electrical concept can significantly enhance students' creativity in verbal and figural aspects.

This study has also examined the effect of virtual laboratory use on problem-solving skills of pre-service physics teachers. Problem-solving ability is one of the higher-order thinking and complex thinking skills that a person can achieve when understanding concepts well. The results of a hypothesis test of problem-solving ability data are shown in Table 2.

Table 2. Hypothesis Test Result of Problem-Solving Ability Data

Mann-Witney	Sig.	Interpretation
Pre-Test	.248	There was no difference in problem-solving skill between the two sample groups
Post-Test	.001	There was a difference between problem-solving skill between the two sample groups
N-gain	.001	There was a difference between N-gain problem-solving skill between the two sample groups

The pre-test hypothesis test showed that there was no difference in students' initial problem-solving skills because students have not received learning and only use the initial knowledge to solve the problem. After being treated, the results of the problem-solving tests of both groups increased. The test results of both groups were statistically significantly different. The experimental group had a significantly higher score than the control group. These results have proven that virtual laboratories have successfully improved students' problem-solving skills. The results of this study have supported previous studies by Oidov et al. [11] who found that virtual experimental activity has helped students perform numerical measurements, evaluating the processes being explored and developing problem-solving skills. Gunawan et al. [18] stated that the virtual laboratory help students to identify the problem and make a plan in solving the problem excellently. In this study, the improved of the problem-solving abilities of pre-service physics teachers are analyzed. Figure 2 shows the results of the pre-test, post-test, and N-gain scores in both groups.

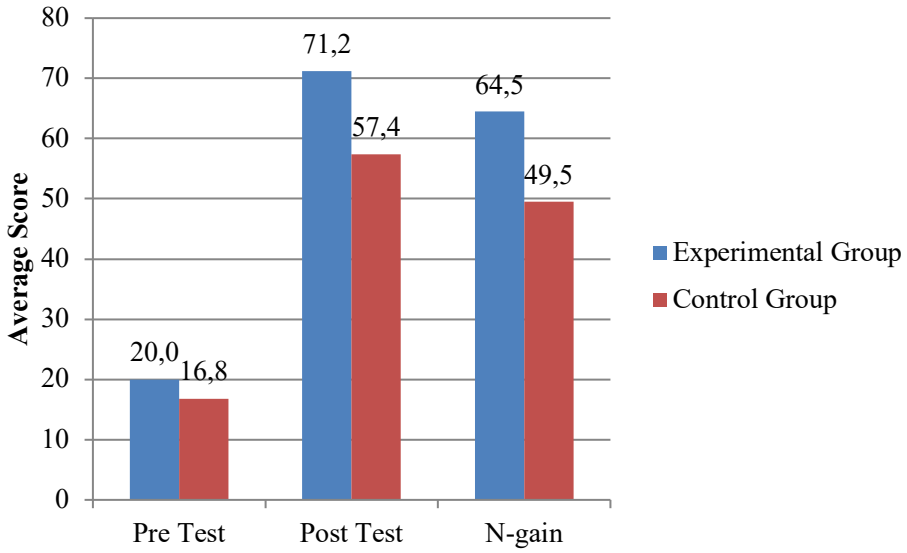

Figure 2. Comparison of Students' Problem-Solving Skill in Both Sample Groups

Based on Figure 2, it can be seen that the increase in the experimental group was significantly higher than the control group. Students' problem-solving abilities are proven to be improved through thermodynamic learning with virtual laboratories. According to Herga & Dinevski [19], the use of virtual labs has supported high-level thinking skills, including problem-solving skills. Virtual laboratories can present animation effectively to teach and visualize abstract concepts or difficult things in science [20]. When students have understood the concept of thermodynamics well, problem-solving abilities will also increase. Virtual laboratories can enhance students' understanding of the

basic concepts of data analysis, problem solving, scientific interpretation [21], numerical concept, and verbal communication [22].

Problem-solving skills in physics require the interpretation and application of one or more types of representation, such as algebra, graphics, and numerical [23]. Thermodynamic learning emphasizes abstract concepts that require visualization in the form of graphs and physical variables. The virtual laboratory on thermodynamic concepts clarifies experimental aspects and graphical visualization. Therefore, this virtual laboratory has been able to support students' ability in solving thermodynamic problems that contain many mathematical equations. Paszkiel [24] revealed that virtual media had transformed the real environment into meaningful images in mathematical calculations. Shyr [25] has reported that virtual laboratories allow students to develop their programs and identify problems related to their implementation. This advantage supports the development of problem-solving skills from pre-service physics teachers in thermodynamic courses.

4. Conclusion

Based on the results of data analysis and discussion it can be concluded that the use of virtual laboratories in learning the concept of thermodynamics has been able to increase the creativity and problem-solving skills of physics teacher candidates. Student creativity in the experimental group was higher than the control group, although the difference was not significantly different. Enhancement of creativity in both groups was in the moderate category. Meanwhile, the problem-solving ability of the experimental group was significantly higher than the control group. The results of this study have proven that the use of virtual laboratory on learning the concept of thermodynamics can improve creativity and problem-solving skills of physics teacher candidates. These results also reinforce previous research on the importance of the role of information technology to improve the thinking skills of prospective teachers.

The recommendations that can be given for further research are: (a) The need to familiarize users with the features of the virtual lab program before the research process is carried out. (b) The need for assistance by technicians and research staff, especially at the initial meetings, given the many technical constraints due to the diverse abilities of students. (3) Problems related to the implementation time of learning that must be tightly controlled so that learning takes place by the plans and objectives set.

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PROTEKSI ISI PROPOSAL
Dilarang menyalin, menyimpan, memperbanyak sebagian atau seluruh isi proposal ini dalam bentuk apapun kecuali oleh pengusul dan pengelola administrasi penelitian

PROPOSAL PENELITIAN 2022

ID Proposal: 192174fe-78b0-487f-a801-12311dd51ca2
Rencana Pelaksanaan Penelitian: tahun 2022 s.d. tahun 2024

1. JUDUL PENELITIAN

PENGEMBANGAN BAHAN AJAR BERBASIS INKUIRI MENGGUNAKAN MEDIA MOODLE UNTUK MENINGKATKAN KREATIVITAS DAN KETERAMPILAN GENERIK SAINS CALON GURU FISIKA

Bidang Fokus RIRN / Bidang Unggulan Perguruan Tinggi	Tema	Topik (jika ada)	Rumpun Bidang Ilmu
Kebijakan dan Inovasi Pendidikan	-	Model dan Perangkat Pembelajaran Inovatif	Pendidikan Fisika

Kategori (Kompetitif Nasional/ Desentralisasi/ Penugasan)	Skema Penelitian	Strata (Dasar/ Terapan/ Pengembangan)	SBK (Dasar, Terapan, Pengembangan)	Target Akhir TKT	Lama Penelitian (Tahun)
Penelitian Desentralisasi	Penelitian Terapan Unggulan Perguruan Tinggi	SBK Riset Terapan	SBK Riset Terapan	6	2

2. IDENTITAS PENGUSUL

Nama, Peran	Perguruan Tinggi/ Institusi	Program Studi/ Bagian	Bidang Tugas	ID Sinta	H-Index
LOVY HERAYANTI Ketua Pengusul	Universitas Pendidikan Mandalika	Pendidikan Fisika	a) Mengkoordinir proses penelitian, seminar, publikasi, dan pelaporan; b) Menyusun model, perangkat dan instrumen; c) Mengimplementasikan model pembelajaran.	5988192	5
BAIQ AZMI SUKROYANTI S.Pd, M.Pd Anggota Pengusul 1	Universitas Pendidikan Mandalika	Pendidikan Fisika	Menyusun lembar validasi model dan perangkat; b) Menyusun lembar observasi dan angket respon; c)Menganalisis & mendeskripsikan hasil penelitian.	6168920	0
FAHMI YAHYA S.Pd, M.Pd Anggota Pengusul 2	Universitas Samawa	Pendidikan Fisika	a) Menyusun dokumen luaran penelitian (artikel publikasi dan seminar, buku ajar, dokumen KI); b) Menyelesaikan masalah administrasi, referensi, dan	6066798	1

			alat/bahan penelitian; c) Mengimplementasikan model pembelajaran		

3. MITRA KERJASAMA PENELITIAN (JIKA ADA)

Pelaksanaan penelitian dapat melibatkan mitra kerjasama, yaitu mitra kerjasama dalam melaksanakan penelitian, mitra sebagai calon pengguna hasil penelitian, atau mitra investor

Mitra	Nama Mitra
Mitra Calon Pengguna	Erma Suryani, M.Pd

4. LUARAN DAN TARGET CAPAIAN

Luaran Wajib

Tahun Luaran	Jenis Luaran	Status target capaian (*accepted, published, terdaftar atau granted, atau status lainnya*)	Keterangan (*url dan nama jurnal, penerbit, url paten, keterangan sejenis lainnya*)
1	Dokumen pendaftaran hak cipta	Terbit Sertifikat	Buku Ajar
2	Dokumen hasil uji	Ada/tersedia	Buku Ajar

Luaran Tambahan

Tahun Luaran	Jenis Luaran	Status target capaian (*accepted, published, terdaftar atau granted, atau status lainnya*)	Keterangan (*url dan nama jurnal, penerbit, url paten, keterangan sejenis lainnya*)
1	Artikel di Jurnal Internasional Terindeks di Pengindeks Bereputasi	Accepted	Internasional Journal Of Instruction
1	Artikel pada Conference/Seminar Internasional	Terbit dalam Prosiding	MISEIC
2	Artikel di Jurnal Internasional Terindeks di Pengindeks Bereputasi	Published	Internasional Journal Of Instruction
2	Artikel pada Conference/Seminar Internasional	Terbit dalam Prosiding	MISEIC

5. ANGGARAN

Rencana anggaran biaya penelitian mengacu pada PMK yang berlaku dengan besaran minimum dan maksimum sebagaimana diatur pada buku Panduan Penelitian dan Pengabdian kepada Masyarakat Edisi 13 Revisi.

Total RAB 2 Tahun Rp. 460,510,000

Tahun 1 Total Rp. 217,640,000

Jenis Pembelanjaan	Komponen	Item	Satuan	Vol.	Biaya Satuan	Total
Bahan	ATK	Cardridge Colour	Buah	6	300,000	1,800,000
Bahan	ATK	Cardridge Black	Buah	6	275,000	1,650,000
Bahan	ATK	Hardisk Eksternal 4 TB	buah	1	1,000,000	1,000,000
Bahan	ATK	Flashdisk 32 GB	buah	6	300,000	1,800,000
Bahan	ATK	Pembelian Alat sebagai pendukung dalam praktikum	paket	1	7,500,000	7,500,000
Bahan	Bahan Penelitian (Habis	Kertas HVS A4	rim	12	45,000	540,000

Jenis Pembelanjaan	Komponen	Item	Satuan	Vol.	Biaya Satuan	Total
	Pakai)					
Bahan	Bahan Penelitian (Habis Pakai)	Kertas HVS F4	rim	10	45,000	450,000
Bahan	Bahan Penelitian (Habis Pakai)	Kertas Buram	rim	10	35,000	350,000
Bahan	Bahan Penelitian (Habis Pakai)	Tinta Printer Hitam	botol	8	80,000	640,000
Bahan	Bahan Penelitian (Habis Pakai)	Tinta printer warna	botol	8	100,000	800,000
Bahan	Bahan Penelitian (Habis Pakai)	Dokumentasi Penelitian	paket	16	500,000	8,000,000
Bahan	Bahan Penelitian (Habis Pakai)	Penggandaan dokumen, perangkat pembelajaran, dan instrumen	paket	1	1,000,000	1,000,000
Bahan	Bahan Penelitian (Habis Pakai)	Penggandaan Buku Ajar	paket	40	500,000	20,000,000
Bahan	Bahan Penelitian (Habis Pakai)	Penggandaan Buku Pedoman Penggunaan Moodle bagi Dosen dan Mahasiswa	eksemplar	30	50,000	1,500,000
Bahan	Bahan Penelitian (Habis Pakai)	Penggandaan dan jilid Proposal penelitian	eksemplar	8	45,000	360,000
Bahan	Bahan Penelitian (Habis Pakai)	Penelusuran Pustaka (Buku, Jurnal, Internet)	paket	6	500,000	3,000,000
Bahan	Bahan Penelitian (Habis Pakai)	Penggandaan dan Jilid Laporan Kemajuan	eksemplar	8	100,000	800,000
Bahan	Bahan Penelitian (Habis Pakai)	Penggadaan/cetak foto atau vidio	paket	1	1,000,000	1,000,000
Pengumpulan Data	FGD persiapan penelitian	FGD Persiapan Penelitian	paket	1	2,800,000	2,800,000
Pengumpulan Data	HR Pembantu Peneliti	Biaya Pengembangan Desain	paket	1	3,000,000	3,000,000
Pengumpulan Data	HR Sekretariat/Administrasi Peneliti	HR Sekretariat/ Administrasi Penelitian	OB	4	600,000	2,400,000
Pengumpulan Data	Transport	Transport Uji Coba Terbatas @ 3 Orang @ 10 kali	OK	30	160,000	4,800,000
Pengumpulan Data	Transport	Transport Uji Coba Skala Luas @ 3 Orang @ 10 kali	OK	30	200,000	6,000,000
Pengumpulan Data	Uang harian rapat di dalam kantor	Uang Harian Rapat di Dalam Kantor @ 5orang @ 5 Kali	OK	25	250,000	6,250,000
Pengumpulan Data	Uang harian rapat di luar kantor	Uang Harian Rapat di Luar Kantor @5 Orang @ 10 Kali	OK	50	100,000	5,000,000
Pengumpulan Data	Biaya konsumsi	Biaya Konsumsi @ 3 Orang @ 10 Kali	OK	30	100,000	3,000,000
Pengumpulan Data	HR Pembantu Lapangan	HR Pembantu Lapangan @ 2 Orang @ 4 Kali	OK	8	250,000	2,000,000
Sewa Peralatan	Peralatan penelitian	Peralatan Penelitian	kali	16	2,000,000	32,000,000

Jenis Pembelanjaan	Komponen	Item	Satuan	Vol.	Biaya Satuan	Total
Sewa Peralatan	Ruang penunjang penelitian	Sewa Ruang Laboratorium	kali	16	1,000,000	16,000,000
Sewa Peralatan	Transport penelitian	Transport Lokal	OK	30	150,000	4,500,000
Analisis Data	HR Sekretariat/Administrasi Peneliti	HR Sekretariat/Administrasi Peneliti	OB	3	500,000	1,500,000
Analisis Data	HR Pengolah Data	Pengumpul data dan Penganalisis data Uji Coba Skala Terbatas @ 3 Orang @ 4 Kali	OB	12	500,000	6,000,000
Analisis Data	HR Pengolah Data	Pengumpul data dan Penganalisis data Uji Coba Skala Luas @ 3 Orang @ 4 Kali	OB	12	500,000	6,000,000
Analisis Data	HR Pengolah Data	Validator Ahli @ 4 Orang @ 2 Paket	OP	8	600,000	4,800,000
Analisis Data	HR Pengolah Data	Insentif Penyusunan Artikel	OK	2	800,000	1,600,000
Analisis Data	HR Pengolah Data	Insentif Penerjemah Artikel	OK	2	800,000	1,600,000
Analisis Data	Transport Lokal	Transport Lokal	OK	5	200,000	1,000,000
Analisis Data	Penginapan	Penginapan	OH	3	600,000	1,800,000
Analisis Data	Biaya konsumsi rapat	Konsumsi Rapat Koordinasi @ 5 Orang @ 5 kali	OK	25	250,000	6,250,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	HR Sekretariat/Administrasi Peneliti	HR Sekretariat/Administrasi Peneliti	OB	3	500,000	1,500,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Uang harian rapat di dalam kantor	Uang Harian Rapat di Dalam Kantor @3 Orang @ 5 Kali	OK	15	250,000	3,750,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Uang harian rapat di luar kantor	Uang Harian Rapat di Luar Kantor @3 Orang @ 5 Kali	OK	15	300,000	4,500,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Biaya konsumsi rapat	Rapat Evaluasi @ 15 Orang	OK	15	250,000	3,750,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Biaya seminar internasional	Registrasi Seminar Internasional MISEIC	paket	2	2,500,000	5,000,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Biaya seminar internasional	Tiket Perjalanan	OK	3	1,500,000	4,500,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Biaya seminar internasional	Penginapan	OK	3	800,000	2,400,000
Pelaporan, Luaran Wajib, dan Luaran	Biaya seminar internasional	Transport Lokal	OK	3	1,000,000	3,000,000

Jenis Pembelanjaan	Komponen	Item	Satuan	Vol.	Biaya Satuan	Total
Tambahan						
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Publikasi artikel di Jurnal Internasional	International Journal of Instruction	paket	1	18,000,000	18,000,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Luaran KI (paten, hak cipta dll)	Biaya Proses Hak Cipta	paket	1	750,000	750,000

Tahun 2 Total Rp. 242,870,000

Jenis Pembelanjaan	Komponen	Item	Satuan	Vol.	Biaya Satuan	Total
Bahan	ATK	Pensil 2B	kotak	2	50,000	100,000
Bahan	ATK	Stabilo	kotak	1	90,000	90,000
Bahan	ATK	Penggaris Besi 30 cm	lusin	1	95,000	95,000
Bahan	ATK	Box File	buah	5	140,000	700,000
Bahan	ATK	Arsip File/Ordner	buah	2	90,000	180,000
Bahan	ATK	Cutter	kotak	1	130,000	130,000
Bahan	ATK	Flashdisk 32 GB	buah	10	200,000	2,000,000
Bahan	ATK	Kabel HDMI 10 m	buah	6	125,000	750,000
Bahan	ATK	Kabel Roll 10 m	buah	6	185,000	1,110,000
Bahan	ATK	Hardisk Eksternal 2 TB	buah	1	1,600,000	1,600,000
Bahan	ATK	Catridge Hitam	buah	3	250,000	750,000
Bahan	ATK	Catridge Warna	buah	2	275,000	550,000
Bahan	Bahan Penelitian (Habis Pakai)	Kertas HVS A4 80 gram	rim	15	55,000	825,000
Bahan	Bahan Penelitian (Habis Pakai)	Kertas HVS F4 80 gram	rim	15	60,000	900,000
Bahan	Bahan Penelitian (Habis Pakai)	Kertas Buram	rim	8	40,000	320,000
Bahan	Bahan Penelitian (Habis Pakai)	Biaya Fotocopy Perangkat	Eksemplar	12	80,000	960,000
Bahan	Bahan Penelitian (Habis Pakai)	Biaya Fotocopy Bahan Ajar	Eksemplar	12	80,000	960,000
Bahan	Bahan Penelitian (Habis Pakai)	Biaya Fotocopy Instrumen	Eksemplar	12	50,000	600,000
Bahan	Bahan Penelitian (Habis Pakai)	Biaya Fotokopi LKM	Eksemplar	240	10,000	2,400,000
Bahan	Bahan Penelitian (Habis Pakai)	Biaya Jilid Perangkat	Eksemplar	12	20,000	240,000
Bahan	Bahan Penelitian (Habis Pakai)	Biaya Fotokopi Laporan Kemajuan	Eksemplar	12	80,000	960,000
Bahan	Bahan Penelitian (Habis Pakai)	Biaya Editing Buku Ajar	Buku	2	2,000,000	4,000,000
Bahan	Bahan Penelitian (Habis Pakai)	Biaya Dokumentasi Penelitian	paket	1	3,000,000	3,000,000
Bahan	Bahan Penelitian (Habis	Biaya Penelusuran	paket	12	600,000	7,200,000

Jenis Pembelanjaan	Komponen	Item	Satuan	Vol.	Biaya Satuan	Total
	Pakai)	Sumber Online				
Pengumpulan Data	FGD persiapan penelitian	FGD Persiapan Penelitian	paket	1	3,000,000	3,000,000
Pengumpulan Data	HR Pembantu Peneliti	Biaya Pengembangan Desain	paket	1	5,000,000	5,000,000
Pengumpulan Data	HR Sekretariat/Administrasi Peneliti	HR Sekretariat/Administrasi Peneliti	OB	5	1,000,000	5,000,000
Pengumpulan Data	Transport	Transport Uji Coba Terbatas @ 3 Orang @ 10 kali	OK	30	160,000	4,800,000
Pengumpulan Data	Transport	Transport Uji Coba Skala Luas @ 3 Orang @ 10 kali	OK	30	200,000	6,000,000
Pengumpulan Data	Uang harian rapat di dalam kantor	Uang Harian Rapat di Dalam Kantor @ 5orang @ 5 Kali	OK	25	250,000	6,250,000
Pengumpulan Data	Uang harian rapat di luar kantor	Uang Harian Rapat di Luar Kantor @5 Orang @ 10 Kali	OK	50	100,000	5,000,000
Pengumpulan Data	Biaya konsumsi	Biaya Konsumsi @ 3 Orang @ 10 Kali	OK	30	100,000	3,000,000
Pengumpulan Data	HR Pembantu Lapangan	HR Pembantu Lapangan @ 2 Orang @ 4 Kali	OK	8	250,000	2,000,000
Sewa Peralatan	Peralatan penelitian	Peralatan Penelitian	kali	20	2,000,000	40,000,000
Sewa Peralatan	Ruang penunjang penelitian	Sewa Ruang Laboratorium	kali	20	1,000,000	20,000,000
Sewa Peralatan	Transport penelitian	Transport Lokal	OK	30	150,000	4,500,000
Analisis Data	HR Sekretariat/Administrasi Peneliti	HR Sekretariat/Administrasi Peneliti	OB	3	2,500,000	7,500,000
Analisis Data	HR Pengolah Data	Pengumpul data dan Penganalisis data Uji Coba Skala Terbatas @ 3 Orang @ 4 Kali	OB	12	1,000,000	12,000,000
Analisis Data	HR Pengolah Data	Pengumpul data dan Penganalisis data Uji Coba Skala Luas @ 3 Orang @ 4 Kali	OB	12	1,200,000	14,400,000
Analisis Data	HR Pengolah Data	Validator Ahli @ 4 Orang @ 2 Paket	OP	8	1,000,000	8,000,000
Analisis Data	HR Pengolah Data	Insentif Penyusunan Artikel	OK	2	1,000,000	2,000,000
Analisis Data	HR Pengolah Data	Insentif Penerjemah Artikel	OK	2	1,500,000	3,000,000
Analisis Data	HR Pengolah Data	Insentif Finalisasi Bahan Ajar	OK	2	2,000,000	4,000,000
Analisis Data	Transport Lokal	Transport Lokal	OK	5	300,000	1,500,000
Analisis Data	Penginapan	Penginapan	OH	3	600,000	1,800,000
Analisis Data	Biaya konsumsi rapat	Konsumsi Rapat	OK	25	250,000	6,250,000

Jenis Pembelanjaan	Komponen	Item	Satuan	Vol.	Biaya Satuan	Total
		Koordinasi @ 5 Orang @ 5 kali				
Pelaporan, Luaran Wajib, dan Luaran Tambahan	HR Sekretariat/Administrasi Peneliti	HR Sekretariat/Administrasi Peneliti	OB	3	600,000	1,800,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Uang harian rapat di dalam kantor	Uang Harian Rapat di Dalam Kantor @3 Orang @ 5 Kali	OK	15	250,000	3,750,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Uang harian rapat di luar kantor	Uang Harian Rapat di Luar Kantor @3 Orang @ 5 Kali	OK	15	300,000	4,500,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Biaya konsumsi rapat	Rapat Evaluasi @ 15 Orang	OK	15	250,000	3,750,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Biaya seminar internasional	Registrasi Seminar Internasional MISEIC	paket	2	2,500,000	5,000,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Biaya seminar internasional	Tiket Perjalanan	OK	3	1,500,000	4,500,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Biaya seminar internasional	Penginapan	OK	3	800,000	2,400,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Biaya seminar internasional	Transport Lokal	OK	3	1,000,000	3,000,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Publikasi artikel di Jurnal Internasional	International Journal of Instruction	paket	1	18,000,000	18,000,000
Pelaporan, Luaran Wajib, dan Luaran Tambahan	Publikasi artikel di Jurnal Internasional	Biaya Proses Hak Cipta	paket	1	750,000	750,000

Isian Substansi Proposal

PENELITIAN TERAPAN UNGGULAN PERGURUAN TINGGI (PTUPT)

Petunjuk:Pengusul hanya diperkenankan mengisi di tempat yang telah disediakan sesuai dengan petunjuk pengisian dan tidak diperkenankan melakukan modifikasi template atau penghapusan di setiap bagian.

Tuliskan judul usulan penelitian

JUDUL USULAN

PENGEMBANGAN BAHAN AJAR BERBASIS INKUIRI MENGGUNAKAN MEDIA MOODLE UNTUK MENINGKATKAN KREATIVITAS DAN KETERAMPILAN GENERIK SAINS CALON GURU FISIKA

Ringkasan penelitian tidak lebih dari 500 kata yang berisi latar belakang penelitian, tujuan dan tahapan metode penelitian, luaran y\ang ditargetkan, serta uraian TKT penelitian yang diusulkan.

RINGKASAN

Penelitian ini dilatar belakangi adanya perkembangan global yang memberikan tantangan tersendiri kepada pendidikan. Perubahan yang cepat dalam bidang ekonomi, teknologi, dan sosial membutuhkan transformasi pendidikan untuk berinovasi dalam berbagai bidang kehidupan. Teknologi digital dinilai sebagi alat yang dapat mengaktifkan mahasiswa untuk mengasah kemampuan memecahkan persoalan yang otentik sesuai jaman, bukan bersikap sebagai penerima pasif ilmu pengetahuan dari guru atau dosen. Wabah corona virus disease 2019 yang telah melanda Indonesia memberikan tantangan tersendiri bagi lembaga pendidikan, khususnya Perguruan Tinggi. Perguruan tinggi dituntut untuk dapat menyelenggarakan perkuliahan atau pembelajaran secara daring atau online sehingga teknologi digital dapat memungkinkan mahasiswa dan dosen melaksanakan proses pembelajaran walaupun mereka ditempat yang berbeda. Bentuk perkuliahan yang dapat dijadikan solusi dalam masa pandemi covid-19 adalah pembelajaran *online* merupakan pembelajaran yang menggunakan jaringan internet dengan aksesibilitas, konektivitas, fleksibilitas, dan kemampuan untuk memunculkan berbagai jenis interaksi pembelajaran. Pembelajaran online dapat dilakukan dengan menyediakan software LMS yang menyediakan fitur-fitur untuk menunjang kegiatan pembelajaran yang dibuat untuk memudahkan seorang dosen mengatur kegiatan pembelajaran dan berinteraksi dengan mahasiswa tanpa terbatas ruang dan waktu. Salah satu LMS yang dapat digunakan adalah *moodle*. Adapun tujuan dari penelitian ini yaitu mengembangkan perangkat pembelajaran berbasis inkuiri menggunakan media moodle untuk meningkatkan kreativitas dan keterampilan generik sains mahasiswa. Penelitian ini termasuk penelitian pengembangan (R&D) yang dilakukan melalui empat tahapan yaitu, studi pendahuluan, pengembangan desain, pengujian perangkat pembelajaran berbasis inkuiri menggunakan media *moodle*, dan diseminasi hasil. Subyek penelitian ini adalah mahasiswa Jurusan Pendidikan Fisika di FSTT UNDIKMA Mataram yang sedang mengikuti perkuliahan Tahun Akademik 2022/2023. Instrumen yang digunakan dalam penelitian berupa tes kreativitas dan keterampilan generik sains, lembar observasi, angket, dan pedoman wawancara. Penelitian direncanakan selama 2 tahun, yaitu pada tahun 2022 dan tahun 2023. Pada tahun pertama pengembangan, akan diselesaikan hingga tahap pengembangan desain perangkat pembelajaran berbasis inkuiri menggunakan media *moodle* dengan hasil akhir berupa produk pengembangan perangkat pembelajaran yang telah divalidasi dan di uji coba pada skala terbatas. Pada tahun kedua akan

dilakukan ujicoba pada skala luas terhadap pengembangan perangkat berbasis inkuiri menggunakan media *moodle* yang telah dikembangkan pada tahun pertama. Tahap terakhir pada penelitian ini yaitu tahap evaluasi untuk melihat hasil dan respon mahasiswa terhadap perangkat yang dikembangkan. Ditargetkan pada tahun pertama akan menghasilkan perangkat pembelajaran yang telah divalidasi dan diujicoba pada skala terbatas, menghasilkan draf buku ajar yang sudah divalidasi, mengikuti seminar Internasional yaitu MISEIC di Surabaya serta publikasi artikel ilmiah pada jurnal IJI yaitu Internasional Journal Of Instruction terhadap perangkat yang dikembangkan pada tahap submit sedangkan pada tahun kedua akan menghasilkan buku ajar ber ISBN dan jurnal internasional pada tahap Accepted/ publist. Penelitian ini mengacu pada TKT Sosial Humaniora dan Pendidikan, yaitu pada tingkat 4 (definisi TKT: pengumpulan data, validasi pada lingkungan simulasi) sampai dengan 6 (definisi TKT: Hasil Litbang penting dan signifikan untuk pendukung keputusan dan kebijakan). Level TKT 4-6 sesuai dengan penelitian yang dilakukan (mengacu pada metode dan tahapan penelitian), dan skema penelitian yang diusulkan (skema PTUPT).

Kata kunci maksimal 5 kata

KATA KUNCI

Inkuiri; *Moodle*; Kreativitas; Generik Sains.

Latar belakang penelitian tidak lebih dari 500 kata yang berisi latar belakang dan permasalahan yang akan diteliti, tujuan khusus dan studi kelayakannya. Pada bagian ini perlu dijelaskan uraian tentang spesifikasi keterkaitan skema dengan bidang fokus atau renstra penelitian PT.

LATAR BELAKANG

Salah satu tantangan pendidikan dewasa ini adalah membangun keterampilan abad 21, diantaranya adalah keterampilan melek teknologi informasi dan komunikasi, keterampilan berpikir kritis, keterampilan memecahkan masalah, keterampilan berkomunikasi efektif dan keterampilan berkolaborasi [1]. Kualitas proses dan hasil belajar fisika di sekolah ditentukan oleh banyak faktor, salah satunya adalah faktor guru. Berangkat dari kenyataan ini tampaknya upaya peningkatan kualitas guru melalui pendidikan calon guru harus terus-menerus dilakukan. Berdasarkan hasil wawancara dengan dosen pada mata kuliah Fisika di Mataram, saat ini masih banyak mahasiswa yang beranggapan bahwa mata kuliah fisika sulit dipahami. Sebagian besar mahasiswa beranggapan bahwa matakuliah Fisika memiliki banyak konsep yang sulit dipahami dan banyak rumus-rumus yang harus dihafal.

Pemenuhan kebutuhan manusia akan informasi menjadi lebih cepat dengan hadirnya internet. Internet sebagai media pembelajaran menjadi salah satu pilihan yang mendukung kegiatan pembelajaran. Media dalam pembelajaran merupakan alat yang membantu terlaksananya proses belajar mengajar [2]. Media pembelajaran adalah semua alat yang digunakan untuk menyampaikan materi pembelajaran kepada pesrta didik yang disusun secara terencana oleh pendidik yang dapat merangsang peserta didik untuk belajar secara efektif dan efisien dalam lingkungan belajar yang kondusif. Penggunaan model pembelajaran yang tepat, metode yang akurat, pendekatan pengajaran yang memberikan dampak signifikan juga harus mendapat perhatian, terutama oleh para pengajar, guru maupun dosen. Media pembelajaran *online* adalah media yang didukunng dengan berbagai kelengkapan seperti alat pengontrol yang bisa diaplikasikan, dikendalikan dan diakses sesuai dengan kebutuhan pengguna. Penggunaan media pembelajaran *online* dalam masa pandemi sangatlah tepat karena berfungsi memudahkan peserta didik dalam kegiatan belajar mengajar, salah satunya melalui platform daring. Dalam masa pandemi penggunaan platform daring sangatlah tepat bagi peserta didik

dalam memudahkan proses kegiatan belajar mengajar, seperti whatsApp, google classroom, *moodle* dan lain sebagainya [3]

Pemanfaatan internet sebagai media pembelajaran dimungkinkan terjadi dengan menyediakan sarana pembelajaran *online* [4]. Pembelajaran *online* dapat dilakukan dengan menyediakan software LMS (*Learning Management System*) yang menyediakan fitur-fitur untuk menunjang kegiatan pembelajaran. LMS merupakan software yang dibuat untuk memudahkan seorang dosen mengatur kegiatan pembelajaran dan berinteraksi dengan mahasiswa tanpa terbatas ruang dan waktu. Salah satu LMS yang dapat digunakan adalah *moodle*. *Moodle* dapat digunakan untuk membangun sistem dengan konsep *e-learning* (pembelajaran secara elektronik). Berbagai bentuk materi pembelajaran dapat dimasukkan dalam aplikasi *moodle*. Tenaga pendidik dituntut untuk selalu meningkatkan kemampuan dalam penggunaan perangkat lunak dan aplikasi-aplikasi daring. Peserta didik pun dituntut untuk mandiri dalam memahami materi yang diberikan dan diajarkan oleh tenaga pendidik dalam pembelajaran daring [5].

Bahan ajar merupakan salah satu komponen yang berperan penting dalam proses pembelajaran. Bahan ajar disusun secara sistematis sehingga peserta didik dengan mudah mempelajari materi yang diberikan didalamnya. Baiknya bahan ajar dibuat dengan menggunakan kalimat yang mudah difahami dan juga bahan ajar yang dibuat dapat menarik perhatian peserta didik sehingga materi yang disampaikan dapat diterima dengan mudah. Bahan ajar yang digunakan selama pembelajaran daring saat ini, banyak berupa softfile atau elektronik.

Berdasarkan uraian latar belakang di atas, maka penulis tertarik untuk melakukan penelitian tentang pengembangan bahan ajar berbasis inkuiri menggunakan media *moodle* untuk meningkatkan kreativitas dan keterampilan generik sains mahasiswa di FSTT UNDIKMA Mataram.

Tinjauan pustaka tidak lebih dari 1000 kata dengan mengemukakan *state of the art* dan peta jalan (*roadmap*) dalam bidang yang diteliti/teknologi yang dikembangkan. Penyajian peta jalan dapat berupa bagan dalam bentuk *image*. Sumber pustaka/referensi primer yang relevan dan dengan mengutamakan hasil penelitian pada jurnal ilmiah dan/atau paten yang terkini.

TINJAUAN PUSTAKA

Model pembelajaran inkuri merupakan model pembelajaran yang menekankan peserta didik pada penyelesaian masalah melalui penemuan. Kelompok siswa yang dibelajarkan dengan model pembelajaran inkuiri memiliki aktivitas siswa yang lebih tinggi dibandingkan dengan kelompok siswa yang tidak menggunakan model pembelajaran inkuiri. Peran aktif siswa sangat penting dalam rangka pembentukan generasi kreatif, yang mampu menghasilkan sesuatu untuk kepentingan dirinya dan orang lain [6]. Menurut Kristianingsih *et al* [7], tujuan umum dari model pembelajaran inkuiri adalah untuk membantu siswa mengembangkan keterampilan intelektual dan keterampilan-ketrampilan lainnya seperti: mengajukan pertanyaan dan ketrampilan menemukan (mencari) jawaban yang berawal dari keingintahuan mereka.

Lovy *et al* [8] mengungkapkan bahwa model inkuiri berbasis komputer dapat memberikan efektifitas yang positif terhadap hasil belajar siswa. Hasil penelitian Mahesti *et al* [9] mengungkapkan bahwa model pembelajaran inkuiri berbantuan laboratorium virtual dapat meningkatkan penguasaan konsep fisika. Peningkatan kelas eksperimen lebih tinggi dibandingkan kelas kontrol pada semua aspek kognitif maupun sub materi optik. Hasil penelitian menunjukkan bahwa siswa perlu diberikan lebih banyak kontekstualisasi bahan ajar dengan kehidupan sehari-hari untuk memudahkan siswa menghubungkan pengetahuan awal

mereka dengan pengetahuan baru yang diajarkan. Penelitian lebih lanjut dengan menggunakan bahan ajar dan lokasi penelitian yang berbeda juga penting di masa mendatang [10].

Pembangunan dan pengembangan *e-learning* saat ini begitu mudahnya dengan perangkat lunak *Learning Management System (LMS)* yang disebut *moodle*. Beberapa penelitian mengemukakan bahwa ada hubungan yang kuat antara penggunaan *Moodl*e sebagai Learning Management System dengan kemampuan akademik siswa. Mwalumbe & Mtebe [11] menyatakan bahwa penggunaan *moodle* sebagai LMS berdampak positif terhadap hasil belajar siswa. Muhtar [12] dalam penelitiannya menyimpulkan bahwa pengembangan pembelajaran *onlin*e menggunakan Learning Management System (LMS) *moodle* juga dapat meningkatkan komptensi guru. Lovy *et al* [13] Fitur-fitur penting penunjang pembelajaran tersebut misalnya tugas, quiz, komunikasi, kolaborasi, serta fitur utama yang dapat meng*upload* berbagai format materi pembelajaran. Untuk mewujudkan proses pembelajaran yang efektif, inovatif, dan menyenangkan yang dapat mengaktifkan peserta didik maka pendidik bisa memanfaatkan semua sumber daya yang ada di sekolah, baik sumber daya manusia, sarana dan prasarana, dan sumber daya yang lain untuk membuat pembelajaran lebih efektif, inovatif, dan menyenangkan.

Moodle singkatan dari *Modular Object Oriented Dynamic Learning Environment* yang berarti tempat belajar dinamis dengan menggunakan model berorientasi objek atau merupakan paket lingkungan pendidikan berbasis web yang dinamis dan dikembangkan dengan konsep berorientasi objek. Selain itu Sayekti [14] mengungkapkan bahwa siswa sangat tertarik dalam mengakses pembelajaran melalui e-learning yang menggunakan *moodle based e-learning* sistem. Melalui *e-learning* tersebut siswa dapat mengakses pembelajaran dimanapun ia berada. Dalam penggunaan *moodle* versi *online*, urutan langkah yang dilakukan adalah dimulai dengan instalasi program *moodle* secara *online* melalui laman web *lovy.ikip-mataram.ac.id*, kemudian dilanjutkan dengan melakukan manajemen data pada *setting profile* dan *administrator*, *manajemen course*, dan diakhiri dengan *enroll user* sesuai dengan fungsi *user* dalam perkuliahan [15].

Kreativitas merupakan salah satu keterampilan yang harus dikembangkan pada siswa melalui pembelajaran di sekolah menengah. Setiap siswa memiliki potensi kreatif yang berbeda-beda. Perbedaan tersebut dapat dipengaruhi oleh cara berpikir, pengalaman, cara menentukan sudut pandang dan faktor lainnya. Pada dasarnya ilmu pengetahuan mencakup aspek proses, produk, dan sikap. Fisika merupakan salah satu bagian dari ilmu pengetahuan yang mempelajari gejala alam sekitar [16]. Kreativitas merupakan salah satu unsur penting dalam pembelajaran fisika tetapi jarang dipelajari untuk mengetahui pengaruh pengajaran yang diterapkan terhadap peningkatan kreativitas. Kesibukan diri yang kreatif tidak hanya bermanfaat bagi orang dan lingkungan, tetapi juga memberikan kepuasan bagi individu. Selain itu, kreativitas juga memungkinkan manusia untuk meningkatkan kualitas hidupnya. Di era pembangunan ini, kemakmuran dan kejayaan masyarakat dan negara bergantung pada kontribusi kreatif, baik berupa ide-ide baru, penemuan-penemuan baru, dan teknologi-teknologi baru [17].

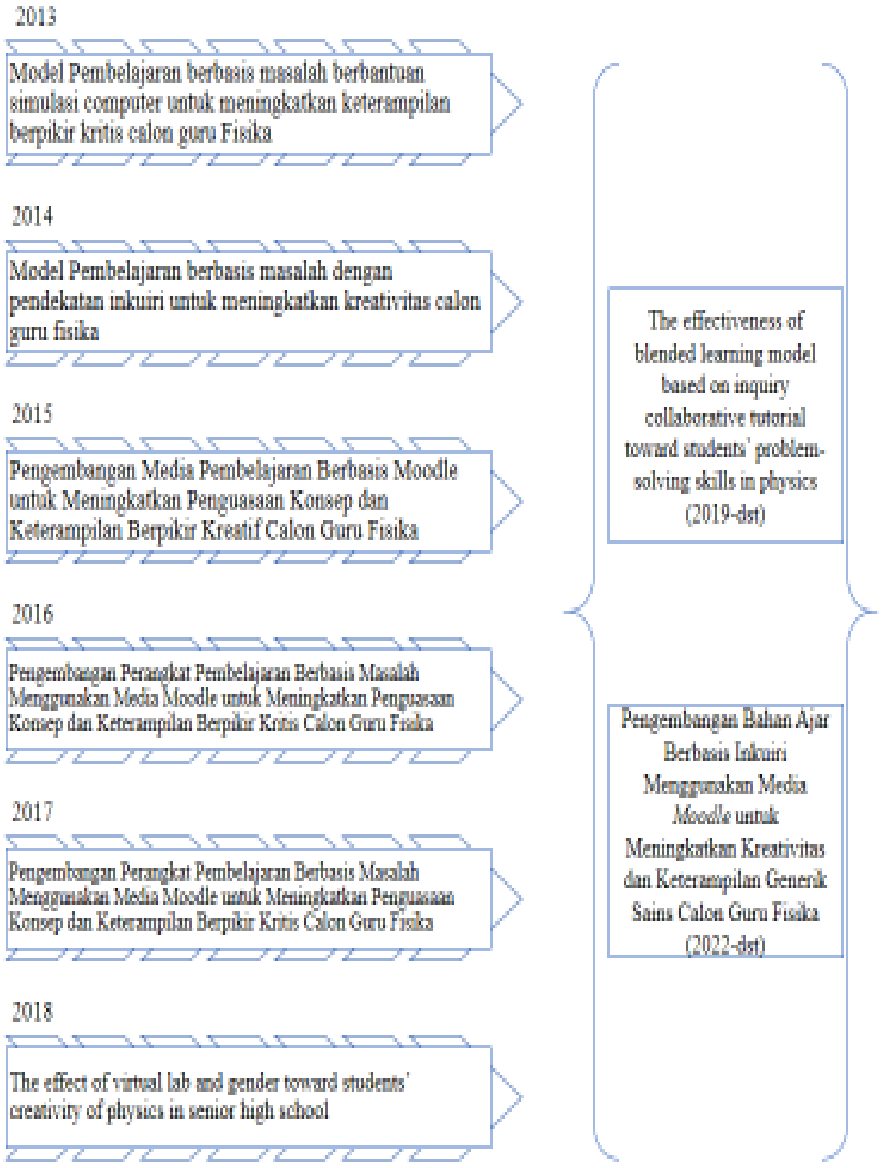
Kreativitas dalam dunia pendidikan sangat perlu ditingkatkan. Mengingat kreativitas merupakan salah satu tujuan pendidikan di seluruh dunia. Desain pembelajaran yang dikembangkan di Indonesia belum menuntut keterampilan dan kreativitas siswa dalam proses belajar mengajar. Dosen harus mampu merangsang mahasiswanya untuk berpikir kritis tentang konsep-konsep filsafat ilmu [18]. Wu *et al* [19] menyatakan bahwa kreativitas memainkan peran penting dalam memperoleh persaingan global, dimana kreativitas merupakan pengetahuan dari otak manusia yang dapat mengubah sesuatu menjadi lebih bernilai dan menawarkan keunggulan yang kompetitif. Dalam dunia pendidikan kreativitas dapat

dikembangkan melalui metode ataupun media pembelajaran yang tepat. Gunawan *et al* [20] mengemukakan bahwa melalui penggunaan model *project based* learning berbantuan media virtual kreativitas verbal maupun figural dapat ditingkatkan.

Keterampilan generik adalah keterampilan yang dibutuhkan untuk menerapkan pengetahuan dalam kehidupan sehari-hari. Menurut Luthvitasari & Linuwih [21] kemampuan generik sains merupakan kemampuan dasar yang dimiliki oleh setiap siswa dan dapat tumbuh serta berkembang melalui pembelajaran fisika. Pujiani [22] juga menjelaskan bahwa kemampuan generik sains merupakan kemampuan yang digunakan secara umum dalam berbagai kerja ilmiah, dan dapat digunakan sebagai landasan dalam melakukan kegiatan laboratorium. Dengan mengembangkan kemampuan generik sains, calon guru juga dilatih untuk berpikir dan bertindak sesuai hakekat sains.

Ciri dari pembelajaran sains melalui keterampilan generik sains adalah membekalkan keterampilan generik sains kepada siswa sebagai pengembangan keterampilan berpikir tingkat tinggi [23]. Yuniarti [24] juga mengungkapkan bahwa kemampuan generik sains dapat mempengaruhi faktor seperti intelegensi, kebiasaan belajar, motivasi siswa, dan sebagainya. Oleh karena itu keterampilan generik sains yang merupakan keterampilan dasar untuk melakukan kerja ilmiah perlu dilatihkan secara terus menerus agar dapat menghasilkan siswa-siswa yang mampu memahami konsep, menyelesaikan masalah, dan kegiatan ilmiah yang lain, serta mampu belajar sendiri dengan efektif dan efisien.

Berdasarkan pada hasil survei peneliti bersama tim, diperoleh beberapa hasil penelitian atau jurnal tentang pemanfaatan *moodle* di dalam proses peningkatan kualitas hasil belajar. Diantaranya dipaparkan secara ringkas pada bagian *state of art*. Hasil penelitian pertama diadopsi dari Sebuah penelitian berjudul "*Customization and Implementation of LMS Moodle*," dipublikasikan oleh seorang peneliti bernama Shivangi Saraswat. Hasil publikasi internasional ini dapat diakses *melalui International Journal of Scientific and Research Publications*, Volume 4, Issue 5, May 2014. ISSN 2250-3153. Rujukan penelitian lainnya adalah pada publikasi Jurnal Pendidikan Fisika dan Teknologi tahun 2018 Volume 4 Nomor 2. ISSN: 2089-6158 dan Jurnal Cakrawala Pendidikan Juni 2017 Nomor 2. ISSN: 0216-1370. Selain itu ada juga merujuk pada Jurnal JPPS tahun 2019 Volume 8 edisi 2, pada Journal of Physics Conference Series tahun 2019 volume 1280 edisi 5 dan pada Journal for the Education of Gifted Young Scienntist (JEGYS).



Gambar 1. *Roadmap* Penelitian.

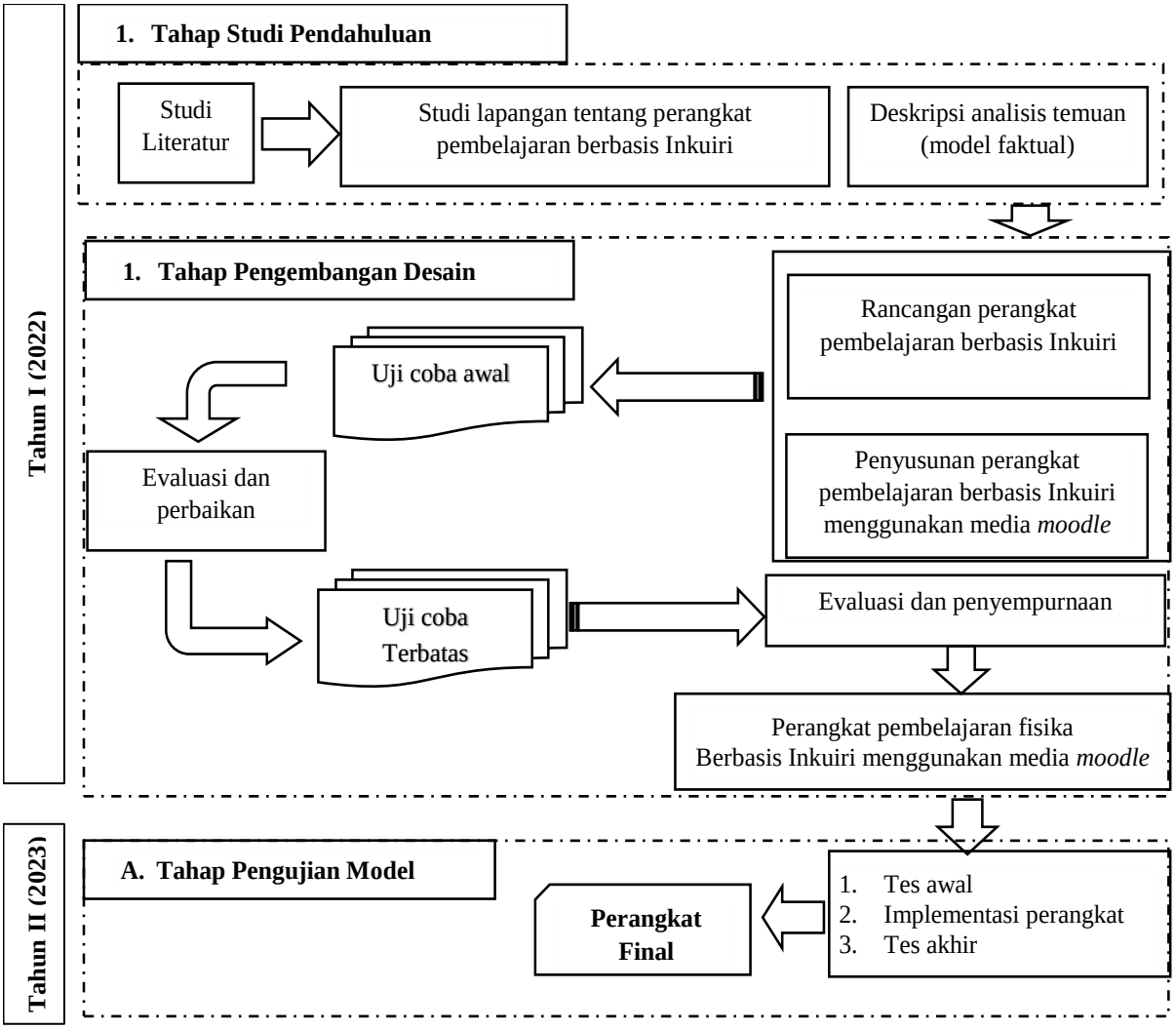
Metode atau cara untuk mencapai tujuan yang telah ditetapkan ditulis tidak melebihi 600 kata. Bagian ini dilengkapi dengan diagram alir penelitian yang akan dikerjakan selama waktu yang diusulkan. Bagan penelitian harus dibuat secara utuh dengan penahapan yang jelas, semua tahapan untuk mecapai luaran beserta indikator capaian yang ditargetkan. Pada bagian ini harus juga dijelaskan tugas masing-masing anggota pengusul sesuai tahapan penelitian yang diusulkan.

METODA

Desain penelitian ini merupakan penelitian pengembangan pendidikan atau *Educational Design Research*. Menurut Gall & Borg [25] *Educational Design Research* merupakan rancangan penelitian yang digunakan untuk menghasilkan suatu produk tertentu melalui suatu proses pengujian. Penelitian ini termasuk penelitian pengembangan (R&D) yang dilakukan melalui empat tahapan yaitu, studi pendahuluan, pengembangan desain, pengujian perangkat pembelajaran berbasis inkuiri menggunakan media *moodle*, dan diseminasi hasil. *Research and Development* merupakan suatu proses atau langkah-langkah untuk mengembangkan suatu produk baru atau menyempurnakan produk yang telah ada, yang dapat dipertanggungjawabkan.

Tahap ini dilakukan dengan menerapkan pendekatan deskriptif kualitatif. Pada tahap studi pendahuluan dilakukan studi lapangan tentang pembelajaran fisika. Selain studi lapangan, juga dilakukan studi literatur tentang pembelajaran fisika, analisis konsep fisika, analisis indikator kreativitas dan keterampilan generik sains yang bersesuaian dengan karakteristik materi fisika terpilih. Selain itu juga dilakukan analisis pada beberapa penelitian yang relevan dengan topik ataupun pengembangan bahan ajar yang akan dikembangkan. Berdasarkan data pada studi kepustakaan dan survey lapangan, pada bagian akhir studi pendahuluan peneliti telah menyusun draf bahan ajar pembelajaran berbasis inkuiri menggunakan media *moodle*

Pada tahap pengembangan desain dikembangkan bahan ajar pembelajaran fisika berbasis inkuiri menggunakan media *moodle*. Draft bahan ajar pembelajaran yang dihasilkan selanjutnya divalidasi oleh ahli. Berdasarkan masukan-masukan dari para ahli, tim peneliti mengadakan penyempurnaan terhadap draf bahan ajar tersebut. Draf yang sudah disempurnakan selanjutnya dilakukan ujicoba awal dan ujicoba terbatas. Adapun tahap penelitian sebagai berikut ditunjukkan pada Gambar 2.



Gambar 2. Tahap Penelitian

Subjek penelitian ini adalah Mahasiswa Program Studi Pendidikan Fisika di FSTT UNDIKMA Mataram yang sedang mengikuti perkuliahan. Dalam rangka memperoleh data yang lengkap dan ketajaman analisis data maka dalam penelitian digunakan beberapa instrumen penelitian, yaitu: (1) Tes kreativitas fisika yang terintegrasi dengan tes keterampilan generik sains. Tes berbentuk pilihan ganda sebanyak 30 soal yang tersebar pada setiap sub konsep dan indikator yang diujikan. (2) Angket skala Likert, dimaksudkan untuk mengetahui tanggapan mahasiswa calon guru dan dosen terhadap bahan ajar yang dikembangkan. (3) Lembar observasi, untuk mengobservasi aktivitas mahasiswa selama proses pembelajaran di kelas sesuai standar pembelajaran sains yang umum.

Terdapat lima jenis data yang dikumpulkan dalam penelitian yaitu: kreativitas, keterampilan generik sains, data observasi pembelajaran, tanggapan dosen terhadap bahan ajar, dan tanggapan mahasiswa terhadap bahan ajar yang dikembangkan. Data yang bersifat kualitatif dianalisis secara deskriptif untuk menemukan kecenderungan-kecenderungan yang muncul pada saat penelitian sedangkan data kuantitatif dianalisis dengan uji statistik.

Untuk mengetahui peningkatan kreativitas dan keterampilan generik sains calon guru dilakukan dengan menghitung besarnya skor gain yang dinormalisasi (N-gain). Hal ini dimaksudkan untuk menghindari kesalahan dalam menginterpretasikan perolehan gain masing-

masing mahasiswa. Untuk memperoleh skor N-gain digunakan rumus yang dikembangkan oleh Hake [26]:

$$\text{N - gain} = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}} \text{ x } 100\%$$

dengan kategori perolehan N – gain : tinggi : g > 70 ; sedang : 30 ≤ g ≤ 70 ; dan rendah : g < 30. Pengolahan data penelitian diawali dengan uji statistik berupa uji normalitas dan uji homogenitas. Adapun rincian tugas masing-masing anggota sebagai berikut ditunjukkan pada Tabel 1.

Tabel 1. Susunan Organisasi Tim Peneliti dan Pembagian Tugas

No	**Nama/NIDN**	**Institusi Asal**	**Bidang Ilmu**	**Alokasi Waktu (bulan)**	**Rincian Tugas**
1.	Dr. Lovy Herayanti, M.Pd/ 0803068101	FSTT UNDIKMA Mataram	Pend. Fisika	10	a) Mengkoordinir proses penelitian, seminar, publikasi, dan pelaporan; b) Menyusun model, perangkat dan instrumen; c) Mengimplementasikan model pembelajaran.
2.	Bq. Azmi Sukroyanti, M.Pd/ 0804028801	FSTT UNDIKMA Mataram	Pend. Fisika	10	Menyusun lembar validasi model dan perangkat; b) Menyusun lembar observasi dan angket respon; c)Menganalisis & mendeskripsikan hasil penelitian.
3.	Fahmi Yahya, M.Pd/ 0821049101	FKIP Universitas Samawa	Pend. Fisika	10	a) Menyusun dokumen luaran penelitian (artikel publikasi dan seminar, buku ajar, dokumen KI); b) Menyelesaikan masalah administrasi, referensi, dan alat/bahan penelitian; c) Mengimplementasik

					an model pembelajaran

Jadwal penelitian disusun dengan mengisi langsung tabel berikut dengan memperbolehkan penambahan baris sesuai banyaknya kegiatan.

JADWAL PENELITIAN

Tahun ke-1

No	Nama Kegiatan	Bulan											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Melakukan analisis terhadap pengembangan bahan ajar.												
2	Mengidentifikasi jenis konsep dalam fisika dan membuat analisis konsepnya.												
3	Mengidentifikasi indikator kreativitas dan keterampilan generik sains yang dapat dikembangkan.												
4	Merumuskan pertanyaan kunci dan masalah-masalah yang berhubungan dengan penerapan konsep fisika.												
5	Membuat desain moodle berbasis inkuiri yang dikembangkan.												
6	Pengembangan bahan ajar berbasis inkuiri menggunakan media *moodle*.												
7	Penyusunan draf bahan ajar dan artikel ilmiah												
8	Melakukan validasi pada perangkat dan materi.												
9	Melakukan ujicoba awal dan ujicoba skala terbatas untuk menyempurnakan bahan ajar yang dikembangkan.												
10	Penyusunan laporan dan publikasi ilmiah												

Tahun ke-2

No	Nama Kegiatan	Bulan											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Persiapan kegiatan lapangan skala luas.												
2	Tes awal dan perlakuan menggunakan moodle berbasis inkuiri												
3	Implementasi bahan ajar yang dikembangakan menggunakan media *moodle*.												
4	Tes akhir menggunakan moodle berbasis inkuiri												

No	Nama Kegiatan	Bulan											
		1	2	3	4	5	6	7	8	9	10	11	12
5	Pengisian angket tanggapan dan wawancara												
6	Pengolahan data penelitian												
7	Penulisan bahan ajar pendukung perangkat pembelajaran berbasis inkuiri												
8	Penyusunan laporan akhir penelitian												
9	Publikasi ilmiah untuk jurnal internasional												

Tahun ke-3

No	Nama Kegiatan	Bulan											
		1	2	3	4	5	6	7	8	9	10	11	12
1													
2													
dst.													

Daftar pustaka disusun dan ditulis berdasarkan sistem nomor sesuai dengan urutan pengutipan. Hanya pustaka yang disitasi pada usulan penelitian yang dicantumkan dalam Daftar Pustaka.

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Publikasi di Jurnal Internasional terindeks

No	Judul Artikel	Peran (First author, Corresponding author, atau co-author)	Nama Jurnal, Tahun terbit, Volume, Nomor, P-ISSN/E-ISSN	URL artikel (jika ada)
1	An Interactive e-Book for Physics to Improve Students' Conceptual Mastery	co-author	International Journal of Emerging Technologies in Learning (iJET), 2020, 15, 5, 1863-0383	https://online-journ
2	Development of guided inquiry learning tools combined with advance organizer to increase students' understanding of physics concept	co-author	Journal of Physics: Conference Series, 2020, 1521, 022014, 1742-6596	https://iopscience.i
3	Enhancement Students' Problem-Solving Ability through Inquiry Learning Model Integrated with Advance Organizers on the Concept of Work and Energy	co-author	Journal of Physics (Conference Series), 2020, 1471, 1, 1742-6596	https://iopscience.i
4	Gender Description on Problem-Solving Skills in Chemistry Learning Using Interactive Multimedia	co-author	Journal for the Education of Gifted Young Scientists, 2020, 8, 1, 2149- 360X	https://dergipark.or
5	Gender Influence on Students Creativity in Physics Learning with Virtual Laboratory	co-author	Journal of Physics (Conference Series), 2020, 1471, 1, 1742-6596	https://iopscience.i
6	Generative learning models assisted by virtual laboratory to improve mastery of student physics concept	co-author	Journal of Physics: Conference Series, 2020, 1521, 022013, 1742-6596	https://iopscience.i
7	Improving Students' Problem-Solving Skills Using Inquiry Learning Model Combined with Advance Organizer	co-author	International Journal of Instruction, 2020, 13, 4, 1694-609X	http://www.e-iji.net
8	The effectiveness of blended learning model based on inquiry collaborative tutorial toward students' problem-solving skills in physics	first author	The effectiveness of blended learning model based on inquiry collaborative tutorial toward students' problem-solving skills in physics, 2020, 8, 3, 2149- 360X	https://dergipark.or
9	GUIDED INQUIRY MODEL THROUGH VIRTUAL LABORATORY TO ENHANCE STUDENTS' SCIENCE PROCESS SKILLS ON HEAT CONCEPT	co-author	Cakrawala Pendidikan, 2019, 38, 2, 2422-8620	https://journal.uny.
10	Learning Management System with Moodle to Enhance Creativity of Candidate Physics	co-author	Journal of Physics: Conference Series, 2019, 1417, 1, 1742-6596	https://iopscience.i

	Teacher			
11	Problem-Based Learning Approach with Supported Interactive Multimedia in Physics Course: Its Effects on Critical Thinking Disposition	co-author	Journal for the Education of Gifted Young Scientists, 2019, 7, 4, 2149- 360X	https://dergipark.or
12	Project-based learning on media development course to improve creativity of prospective physics teacher	co-author	AIP Conference Proceedings, 2019, 2194, 1, 0094243X	https://aip.scitatio
13	Using Virtual Laboratory to Improve Pre-service Physics Teachers' Creativity and Problem-Solving Skills on Thermodynamics Concept	co-author	Journal of Physics: Conference Series, 2019, 1280, 5, 1742-6596	https://iopscience.i
14	Developing Moodle in Problem-Based Learning to Improve Student Comprehension on the Concepts of Wave		Advances in Intelligent Systems Research (AISR), 2018, 157, 1, 1951-6851	https://download.atl
15	Enhancing students' creativity in physics classroom using virtual laboratory	co-author	Advances in Social Science, Education and Humanities Research, 2018, 262, 1, 2352-5398	https://www.atlantis
16	Students' Problem-Solving Skill in Physics Teaching with Virtual Labs		International Journal of Pedagogy and Teacher Education (IJPTE), 2018, 2, 1, 2549-8525	https://www.research
17	The effect of virtual lab and gender toward students' creativity of physics in senior high school		Journal of Physics: Conf. Series, 2018, 1108, 1, 1742-659	doi :10.1088/1742-65
18	The effect of virtual labs toward students' understanding of physics based on gender	co-author	Advances in Social Science, Education and Humanities Research, 2018, 173, 1, 2352-5398	https://www.atlantis
19	Virtual Laboratory to Improve Students' Conceptual Understanding in Physics Learning		Journal of Physics: Conf. Series, 2018, 1108, 1, 1742-6596	doi :10.1088/1742-65
20	Investigating Students Creativity Based on Gender by Applying Virtual Laboratory to Physics Instruction	co-author	Advance in Social Science, Education and Humanities Research, 2017, 158, 303-310., 2352-5398	http://creativecommo
21	Virtual Laboratory to Improve Students' Problem-Solving Skills on Electricity Concept	co-author	Jurnal Pendidikan IPA Indonesia, 2017, 6, 2, 2089-4392	https://journal.unne
22	VIRTUAL LABORATORY TO IMPROVE STUDENTS' PROBLEM-SOLVING SKILLS ON ELECTRICITY CONCEPT		Jurnal Pendidikan IPA Indonesia (JPII), 2017, 6, 2, 2089-4392	https://journal.unne

Publikasi di Jurnal Nasional Terakreditasi Peringkat 1 dan 2

No	Judul Artikel	Peran (First author, Corresponding author, atau co-author)	Nama Jurnal, Tahun terbit, Volume, Nomor, P-ISSN/E-ISSN	URL artikel (jika ada)
1	Investigating Student's Critical Thinking Disposition Based on Gender In Physics Teaching With Interactive Multimedia	co-author	JPPS (Jurnal Penelitian Pendidikan Sains), 2020, 9, 1, 2549-4597.	https://journal.unes

2	Blended Learning Based Inquiry Collaborative Tutorial Model for Physics Students		JPPS (Jurnal Penelitian Pendidikan Sains) , 2019, 8, 2, 2549-1597	https://journal.unes
3	Effect of Scientific Approach toward Students' Critical Thinking Skills		Lensa: Jurnal Kependidikan Fisika , 2019, 7, 1, 2686-0937	http://ojs.ikipmatar
4	Guided Inquiry Model Through Virtual Laboratory to Enhance Students'science Process Skills on Heat Concept		Jurnal Cakrawala Pendidikan, 2019, 38, 2, 2442-8620	https://journal.uny.
5	Improving Student Learning Outcomes through Contextual Approach based on Learning Community		Lensa: Jurnal Kependidikan Fisika, 2019, 7, 1, 2686-0937	http://ojs.ikipmatar
6	INQUIRY COLLABORATIVE TUTORIAL BASED BLENDED LEARNING MODEL FOR PHYSICS COLLEGE STUDENTS		Jurnal Penelitian Pendidikan Sains (JPPS), 2019, 8, 2, 2549-4597, 2089-1776	https://journal.unes
7	Pelatihan Pembuatan Video Pembelajaran Bagi Guru-Guru Di Sdn 1 Ubung Dengan Memanfaatkan Bandicam	first author	Jurnal Pendidikan dan Pengabdian Masyarakat, 2019, 2, 4, 2614-7939)	https://jurnalfkip.u
8	PEMBELAJARAN MENDESAIN RUMAH MENGGUNAKAN MEDIA AUDIO VISUAL DENGAN MEMANFAATKAN BANDICAM		Jurnal Pendidikan Fisika dan Teknologi, 2019, 5, 2, 2407-6902	http://jurnalfkip.un
9	PERSEPSI CALON GURU TERHADAP MODEL E-ASSESSMENT DALAM PEMBELAJARAN FISIKA		Jurnal Pendidikan Fisika dan Teknologi, 2019, 5, 1, 2407-6902	https://jurnalfkip.u
10	The Effect of Mind Mapping Media toward Physics Concepts Understanding		Lensa: Jurnal Kependidikan Fisika , 2019, 7, 1, 2686-0937	http://ojs.ikipmatar
11	Perbedaan hasil kemampuan berpikir kritis dan berpikir kreatif siswa menggunakan handout berbasis pemecahan masalah	co-author	Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram, 2018, 6, 1, 2540-7899	http://jurnal.ikipma
12	Pengembangan Media Pembelajaran Berbasis Moodle pada Matakuliah Fisika Dasar."	first author	Jurnal Cakrawala Pendidikan, 2017, 36, 2, 2442-8620	https://journal.uny.
13	PENGEMBANGAN MEDIA PEMBELAJARAN BERBASIS MOODLE PADA MATAKULIAH FISIKA DASAR		Cakrawala Pendidikan, 2017, XXXVI, 2, 2442-8620	https://journal.uny.
14	Virtual Laboratory of Electricity Concept to Improve Prospective Physics Teachers' Creativity	co-author	Jurnal Pendidikan Fisika Indonesia, 2017, 13, 2, 2355-3812	https://doi.org/10.
15	VIRTUAL LABORATORY OF ELECTRICITY CONCEPT TO IMPROVE PROSPECTIVE PHYSICS TEACHERS' CREATIVITY		Jurnal Pendidikan Fisika Indonesia, 2017, 13, 2, 2355-3812	https://journal.unne

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No	Judul Artikel	Peran (First author, Corresponding	Nama Jurnal, Tahun terbit, Volume, Nomor, P-ISSN/E-ISSN	URL artikel (jika ada)

		author, atau co-author)		
1	Pengaruh Model Pembelajaran Take and Give Untuk Meningkatkan Hasil Belajar Siswa	co-author	Prosiding Seminar Nasional Lembaga Penelitian Dan Pendidikan (LPP) Mandala, 2018, 2, 1, 2615-6881	http://ejournal.mand
2	Pengaruh Model Pembelajaran Talking Stick terhadap Keaktifan Belajar Siswa	co-author	e-Saintika, 2018, 2, 1, 2623-2774	https://www.neliti.c
3	kajian literatur tentang membelajarkan keterampilan berpikir kritis menggunakan blanded learning	first author	Seminar Nasional PKPSM IKIP MATARAM, 2016, -, -, 978-602-74245-0-0	semnaspkpsm@gmail.co
4	model pembelajaran berbasis masalah berbantuan simulasi komputer untuk meningkatkan keterampilan berpikir kritis calon guru fisika	first author	seminar nasional pendidikan sains, 2013, -, -, 2354-7022	psains-fkip.uns.ac.i
5	model pembelajaran berbasis masalah untuk meningkatkan penguasaan konsep calon guru fisika	first author	Seminar Nasional Fisika dan Pendidikan Fisika, 2014, 5, 1, 2302-7827	http://snfpf.fkip.un

Buku

No	Judul Buku	Tahun Penerbitan	ISBN	Penerbit	URL (jika ada)
1	Gelombang	2018	9786020756028	Arga Puji Press	-
2	Buku Ajar Fisika Dasar 1	2016	978-602-73458-4-3	Duta Pustaka Ilmu	dutapustakailmu@yaho
3	Fisika Dasar II	2016	978-602-6800-33-6	Arga Puji Press	www.argapuji.com

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Publikasi di Jurnal Internasional terindeks

No	Judul Artikel	Peran (First author, Corresponding author, atau co-author)	Nama Jurnal, Tahun terbit, Volume, Nomor, P-ISSN/E-ISSN	URL artikel (jika ada)
1	Developing Moodle in Problem-Based Learning to Improve Student Comprehension on the Concepts of Wave		Advances in Intelligent Systems Research (AISR), 2018, 157, 1, 1951-6851	https://download.atl

Publikasi di Jurnal Nasional Terakreditasi Peringkat 1 dan 2

No	Judul Artikel	Peran (First author, Corresponding author, atau co-author)	Nama Jurnal, Tahun terbit, Volume, Nomor, P-ISSN/E-ISSN	URL artikel (jika ada)
1	The Effect of Mind Mapping Media toward Physics Concepts Understanding		Lensa: Jurnal Kependidikan Fisika , 2019, 7, 1, 2686-0937	http://ojs.ikipmatar

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No	Judul Artikel	Peran (First author, Corresponding author, atau co-author)	Nama Jurnal, Tahun terbit, Volume, Nomor, P-ISSN/E-ISSN	URL artikel (jika ada)

Buku

No	Judul Buku	Tahun Penerbitan	ISBN	Penerbit	URL (jika ada)
1	FISIKA MODERN	2017	978-602-50418-5-3	Duta Pustaka Ilmu	-

Perolehan KI

No	Judul KI	Tahun Perolehan	Jenis KI	Nomor	Status KI (terdaftar/granted)	URL (jika ada)
1	Perangkat Pembelajaran Fisika "Momentum dan Impuls"	2019	Hak Cipta	000156747	Granted	-

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Publikasi di Jurnal Internasional terindeks

No	Judul Artikel	Peran (First author, Corresponding author, atau co-author)	Nama Jurnal, Tahun terbit, Volume, Nomor, P-ISSN/E-ISSN	URL artikel (jika ada)
1	Using virtual laboratory to improve pre-service physics teachers' creativity and problem-solving skills on thermodynamics concept	co-author	Journal of Physics: Conference Series, 2019, 2019, 1280, 1742-6596	https://iopscience.i

Publikasi di Jurnal Nasional Terakreditasi Peringkat 1 dan 2

No	Judul Artikel	Peran (First author, Corresponding author, atau co-author)	Nama Jurnal, Tahun terbit, Volume, Nomor, P-ISSN/E-ISSN	URL artikel (jika ada)
1	Pelatihan Desain Grafis untuk Kelompok Pemuda Kreatif Desa Gontar Kecamatan Alas Barat Kabupaten Sumbawa	first author	Jurnal Pendidikan dan Pengabdian Masyarakat, 2020, 3, 2, 2614-7939	http://jurnalfkip.un
2	Pendampingan persiapan olimpiade sains nasional (OSN) tingkat kabupaten bagi siswa SMA Negeri 4 Sumbawa	co-author	Jurnal Pendidikan dan Pengabdian Masyarakat, 2019, 2, 1, 2614-7939	https://jurnalfkip.u
3	Virtual Experiment Untuk Meningkatkan Pemahaman Siswa Pada Konsep Getaran Dan Gelombang	first author	Jurnal Pendidikan Fisika dan Teknologi, 2019, 5, 1, 2407-6902	http://www.jurnalfki
4	VIRTUAL EXPERIMENT UNTUK MENINGKATKAN PEMAHAMAN SISWA PADA KONSEP GETARAN DAN GELOMBANG		Jurnal Pendidikan Fisika dan Teknologi, 2019, 5, 1, 2407-6902	http://jurnalfkip.un
5	Pengaruh model pembelajaran berbasis masalah berbantuan simulasi interaktif terhadap keterampilan generik sains siswa SMA pada materi elastisitas	first author	Jurnal Pendidikan Fisika dan Teknologi, 2016, 2, 3, 2407-6902	https://jurnalfkip.u

Prosiding seminar/konverensi internasional terindeks

No	Judul Artikel	Peran (First author, Corresponding author, atau co-author)	Nama Jurnal, Tahun terbit, Volume, Nomor, P-ISSN/E-ISSN	URL artikel (jika ada)
1	Village Development Program for Producing Iodized Salt for	corresponding author	Annual Conference on Health and Food Science Technology, 2020, -,	https://iopscience.i

	Sustainable Development Community		-, 1755-1315	
2	Pengembangan Multimedia Interaktif Model Tutorial Berbasis Android Flash Materi Cahaya Siswa SMP Kelas VIII	corresponding author	Prosiding Seminar Nasional Pendidikan, 2016, -, -, 9786021570425	https://drive.google
3	Development of Diagnostic and Remedial Program-Based Interactive Multimedia to Reduce Student's Misconceptions on Geometric Optics	first author	Proceedings International Conference on Mathematics, Sciences and Education, 2015, -, -, 9786021570425	http://lib.um.ac.id/
4	Lecturers' and Students' Profiles and Perceptions on the Implementation of Online Learning Evaluations During the Covid-19 Pandemic	corresponding author	Proceedings of the 2nd Annual Conference on Education and Social Science (ACCESS 2020), 2020, , , 2352-5398	https://www.atlantis
5	Correlation of Online Learning Evaluation With Students' Learning Outcomes in the Covid 19 Pandemic	corresponding author	Proceedings of the 2nd Annual Conference on Education and Social Science (ACCESS 2020), 2020, , , 2352-5398	https://www.atlantis
6	The Use of Whatsapp Application in Learning Evaluation Activities During Covid-19 Pandemic	first author	Proceedings of the 2nd Annual Conference on Education and Social Science (ACCESS 2020), 2020, , , 2352-5398	https://www.atlantis

Buku

No	Judul Buku	Tahun Penerbitan	ISBN	Penerbit	URL (jika ada)
1	PENGEMBANGAN POTENSI DESA LABUHAN BAJO MELALUI PEMBERDAYAAN PETAMBAK GARAM	2021	978-623-348-382-7	INSAN CENDEKIA MANDIRI	https://isbn.perpusn

Perolehan KI

No	Judul KI	Tahun Perolehan	Jenis KI	Nomor	Status KI (terdaftar/granted)	URL (jika ada)
1	Pemberdayaan Kelompok Setia Kawan Dalam Produksi Garam Beryodium Di Desa Labuhan Bajo, Sumbawa	2020	Hak Cipta		Terdaftar	https://drive.google

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Skema/Program Penelitian	: Penelitian Terapan Unggulan Perguruan Tinggi
Judul Penelitian	: Pengembangan Bahan Ajar Berbasis Inquiry Menggunakan Media Moodle Untuk Meningkatkan Kreativitas Dan Keterampilan Generik Sains Calon Guru Fisika
Tahun Pengusulan	: 2022

Bersama ini menyatakan bersedia bekerjasama dalam penelitian untuk penciptaan produk bahan ajar berbasis inquiry menggunakan media *moodle* yang kami butuhkan untuk meningkatkan kreativitas dan keterampilan generik sains calon guru fisika di Program Studi Pendidikan Fisika.

Dalam rangka mendukung penciptaan produk tersebut, institusi kami bersedia menyediakan dukungan berupa ruang perkuliahan, lab *microteaching* dan menugaskan:

Nama	: Fahmi Yahya, M.Pd.
Kedudukan dalam	: Dosen Prodi Pendidikan Fisika
Institusi	: FKIP Universitas Samawa
Bidang keahlian	: Pendidikan Fisika

sebagai anggota peneliti yang berasal dari institusi yang kami pimpin.

Demikian surat penyataan kemitraan penelitian ini dibuat dengan penuh kesadaran dan tanggung jawab.

Mataram, 7 Februari 2022

Erma Suryani, M.Pd
NIDN. 0804058701

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PERSETUJUAN USULAN

Tanggal Pengiriman	Tanggal Persetujuan	Nama Pimpinan Pemberi Persetujuan	Sebutan Jabatan Unit	Nama Unit Lembaga Pengusul
14 Februari 2022	20 Februari 2022	Dr AKHMAD SUKRI S.Pd, M.Pd	Ketua	Lembaga Penelitian dan Pengabdian kepada Masyarakat Universitas Pendidikan Mandalika (LPPM UNDIKMA)

UNIVERSITAS SAMAWA (UNSA) SUMBAWA BESAR
FAKULTAS KEGURUAN DAN ILMU PENDIDIKAN
PROGRAM STUDI: TEKNOLOGI PENDIDIKAN, PENDIDIKAN EKONOMI, PENDIDIKAN FISIKA, PENDIDIKAN BAHASA & SASTRA INDONESIA DAN PENDIDIKAN BIOLOGI
Alamat: Jln. Raya By Pass Sering, Sumbawa Besar, Telepon/Faks (0371) 625848

SURAT PERNYATAAN MITRA CALON PENGGUNA

Yang bertanda tangan di bawah ini:

Nama Pimpinan Institusi Mitra	: Erma Suryani, M.Pd.
Nama Institusi	: FKIP Universitas Samawa
Alamat Kantor	: Jl. Raya By Pass Sering, Sumbawa Besar
Jabatan	: Dekan
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Bersepakat untuk bermitra dengan:

Nama Ketua Peneliti	: Dr. Lovy Herayanti, M.Pd.
Institusi	: Fakultas Sains, Teknik, dan Terapan (FSTT) Universitas Pendidikan Mandalika Mataram (UNDIKMA)
Alamat Kantor	: Jl. Pemuda No 59A Mataram, NTB
Skema/Program Penelitian	: Penelitian Terapan Unggulan Perguruan Tinggi
Judul Penelitian	: Pengembangan Bahan Ajar Berbasis Inquiry Menggunakan Media Moodle Untuk Meningkatkan Kreativitas Dan Keterampilan Generik Sains Calon Guru Fisika
Tahun Pengusulan	: 2022

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