

# Application of LMS, Google Meet, and PhET Interactive Simulations as an Effort to Develop Student Creativity and Communication Skills in Waves and Optics lectures

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**Abstract:** This research aims to describe the application of the Learning Management System (LMS), Google Meet, and PhET interactive simulations as an effort to develop student creativity and communication skills in Waves and Optics lectures. This research, which uses a one shot case study design, was carried out in the 2023 academic year (odd semester) at the Physics Education Study Program, FKIP, University of Mataram. The research subjects included all University of Jambi students who took Waves and Optics courses with code 133414. These students took part in the Independent Campus program, namely the Independent Student Exchange (ISE), with a total of 20 people. The instrument for creativity uses a product assessment sheet uploaded to the LMS, namely SPADA Unram, while the instrument for communication skills uses an observation sheet during product presentations via Google Meet. The product in question is a paper that discusses a particular topic accompanied by data from PhET interactive simulations. The assessment score for each indicator for both creativity and communication skills uses a scale of 4. The scores for creativity and communication skills are expressed in percentage form. The research results show that the average score for student creativity is 83.0 (B+ criteria), while student communication skills are 86.8 (A criteria). The lowest score in the creativity aspect is 75 (B criteria) with the highest score being 90 (A criteria). The lowest score in the communication skills aspect is 80 (B+ criteria) with the highest score being 90 (A criteria). Thus, implementing LMS, Google Meet, and PhET interactive simulations can be an alternative in developing creativity and communication skills. Optimizing learning media needs to be done to produce better creativity and communication skills.

**Keywords:** Creativity; Communication Skills; Google Meet; LMS; PhET Simulations

## Introduction

The Ministry of Education, Culture, Research and Technology through its official website, namely the link <https://kampusmerdeka.kemdikbud.go.id/> provides information that the Independent Campus is a policy issued by the Ministry which gives students the right to take courses outside the study program for 1 semester and carry out activities outside the university for 2 semesters. Universities are given the freedom to provide Independent Campus activities that suit the needs and interests of their students. There are 9 types of activities available in the Independent Campus program, namely: 1) Certified Internship; 2) Independent Study; 3) Teaching Campus; 4) Indonesian International Student Mobility Awards (IISMA); 5) Independent Student

Exchange; 6) Building Villages (Thematic KKN); 7) Humanitarian Projects; 8) Research; 9) Entrepreneurship (Insani et al., 2021).

The Independent Student Exchange (ISE) Program has several benefits, including increasing student tolerance (Anwar, 2022b). The ISE program provides opportunities for students to explore cultural diversity in the destination area (Pasaribu et al., 2023). This program has increased interest from generation to generation (Batau et al., 2022). They have high motivation to take part in the Independent Student Exchange program (Anwar, 2022a). Character values in the form of good morals are also a benefit of this activity (Wulan et al., 2023). In general, this program has been able to improve the quality of lectures (Anggraini et al., 2022). Government policy in this case is in accordance

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with current developments and the demands of the world of work (Arsyad & Widuhung, 2022). However, students need to adapt to the culture shock of the Independent Student Exchange program (Mufidah & Fadilah, 2022).

The 5th program (Independent Student Exchange) requires lectures to be held online. Therefore, lecturers need to plan online lectures well so that learning objectives can be realized. Online lectures can use an LMS or Learning Management System such as that of the University of Mataram as one of the universities that implements various MBKM (Merdeka Belajar Kampus Merdeka) programs which can help the effectiveness of lectures (Saputro & Susilowati, 2019), the quality of the learning process and outcomes becomes better (Simanullang & Rajagukguk, 2020), especially during the pandemic (Raza et al., 2021). The LMS owned by University of Mataram or SPADA (Online Learning System) can be accessed via the link: <https://daring.unram.ac.id/>

Online lectures using various platforms such as LMS and Google Meet can improve various student competencies which are very useful in the future. The 21st-century skills in question include 16 skills which are divided into three categories, namely: Foundational Literacies (literacy, numeracy, scientific literacy, ICT literacy, financial literacy, cultural and civic literacy); Competencies (Critical thinking/problem solving, creativity, communication, collaboration); dan Character Qualities (curiosity, initiative, persistence/grit, adaptability, leadership, social and cultural awareness). All of these skills can be trained through Lifelong Learning (Khoirunnisa & Habibah, 2020).

The use of LMS and Google Meet can be combined with PhET interactive simulations, especially for abstract concepts in Waves and Optics lectures. The use of PhET interactive simulations has been proven to make it easier for students to understand concepts and even master various science process skills (Astuti & Handayani, 2018), as well as increasing interest in learning (Heryanti et al., 2021). PhET interactive simulations have improved learning activities (Marlinda et al., 2016) and student learning outcomes in all aspects (Rusnita, 2019). This can certainly be a consideration for lecturers to apply a combination of LMS, Google Meet and PhET interactive simulations to develop various 21st-century skills, especially creativity and communication. The aim of this research is to describe the application of the Learning Management System (LMS), Google Meet, and PhET interactive simulations as an effort to develop student creativity and communication skills in Waves and Optics courses.

## Method

This research, which uses a one shot case study design, was carried out in the 2023 academic year (odd semester) at the Physics Education Study Program, FKIP, University of Mataram. The research subjects included all University of Jambi students who took Waves and Optics courses with code 133414. These students took part in the Independent Campus program, namely the Independent Student Exchange (ISE), with a total of 20 people. The course identity with code 133414 for the University of Jambi (UNJA) ISE program found in the University of Mataram Academic Information System (SIA) can be seen in Figure 1. The Unram SIA link is: <https://sia.unram.ac.id/>

Nama	gelombang dan optik
Kode	133414
Kelas	UNJA
Ruang	D-104
Jam	12:50 - 15:20 (3 SKS)
Durasi	11:25 am – 1:11 pm
Tanggal	2023-12-05
Hadir : 19	Sakit : 0
Izin : 0	Alpa : 1
Lain : 0	

**Figure 1.** Lecture identity

The instrument for creativity uses a product assessment sheet uploaded to the LMS, namely SPADA Unram, while the instrument for communication skills uses an observation sheet during product presentations via Google Meet. The product in question is a paper that discusses a particular topic accompanied by data from PhET interactive simulations. PhET interactive Simulations link is: <https://phet.colorado.edu/en/>.

Each meeting was filled with 2 groups presenting (each group consisting of two students), so that the total of meetings for this research was 5 times with a total of 10 topics. These topics can be seen in Table 1.

**Table 1.** Waves and Optics lecture topics using PhET interactive simulations media

Group	Topic
1	Sound Waves
2	Geometric Optics: Basics
3	Fourier: Making Waves
4	Waves Intro
5	Blackbody Spectrum
6	Wave Interference
7	Bending Light
8	Molecules and Light
9	Wave on a String
10	Color Vision

Indicators of creativity in producing products in the form of papers uploaded to the LMS, namely SPADA

UNRAM, are: 1) systematic writing; 2) accuracy of data sources; 3) quantity of data sources; 4) data analysis; 5) conclusion. Indicators of student communication skills when presenting via Google Meet are: 1) using correct grammar; 2) speak clearly and easily understand; 3) use the right vocabulary choices; 4) voice intonation according to the message conveyed; 5) express opinions using appropriate language. The assessment score for each indicator for both creativity and communication skills uses a scale of 4. The value is obtained using the equation:

$$Value = \frac{Score\ obtained}{Maximum\ score} \times 100 \quad (1)$$

The degree of mastery and value conversion or student competency criteria can be seen in Table 2.

**Table 2.** Degree of Mastery and Criteria

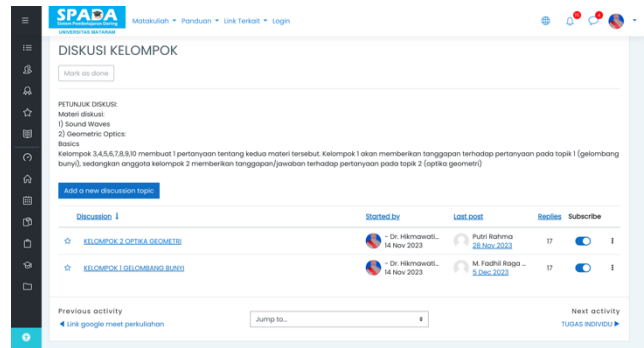
Degree of Mastery	Criteria
85 - 100	A
80 - < 85	B+
75 - < 80	B
70 - < 75	C+
65 - < 70	C
55 - < 65	D+
45 - < 55	D
0 - < 45	E

**Result and Discussion**

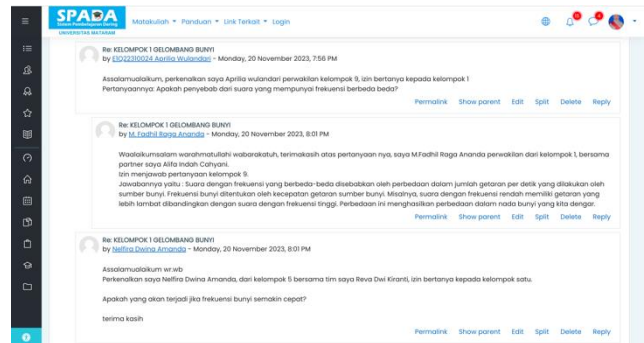
The LMS on SPADA Unram has many menus including: Assignment, Attendance, BigBlueButton, Book, Chat, Choice, Database, External tool, Feedback, File, Folder, Forum, Glossary, H5P, IMS content package, Interactive content, Label, Lesson, Page, Quiz, SCORM package, Survey, URL, Wiki, Workshop. This research uses a menu, namely Assignment, File, Forum, and Quiz. The Assignment menu is used to give assignments to students; File menu is used to share material; the Forum menu is used for discussion; The Quiz menu is used to carry out tests. The LMS menu on SPADA Unram can be seen in Figure 1a, on-line discussion instructions can be seen in Figure 2b, and discussion activities can be seen in Figure 3c.



**Figure 1a.** SPADA Unram menu



**Figure 1b.** On-line Discussion Guide

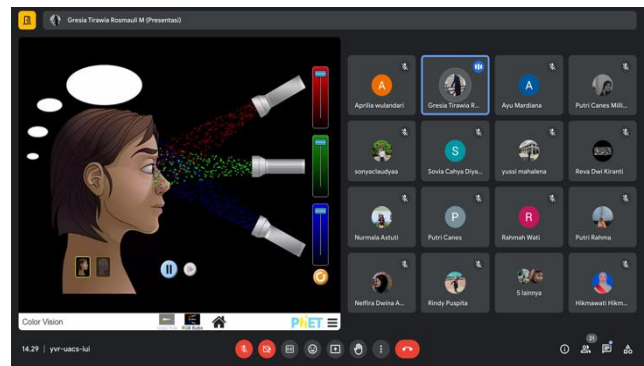


**Figure 1c.** Discussion Activities at SPADA Unram

Lectures via Google Meet using PhET interactive simulations media can be seen in Figure 2. Figure 2a is a group presentation on the topic Wave on String. Figure 2b is a group presentation on the topic Color Vision.



**Figure 2a.** Wave on String



**Figure 2b.** Color Vision

The research results show that the average score for student creativity is 83.0 (B+ criteria), while student communication skills are 86.8 (A criteria). The lowest score in the creativity aspect is 75 (B criteria) with the highest score being 90 (A criteria). The lowest score in the communication skills aspect is 80 (B+ criteria) with the highest score being 90 (A criteria). The value of student creativity and communication skills can be seen in Figure 3.

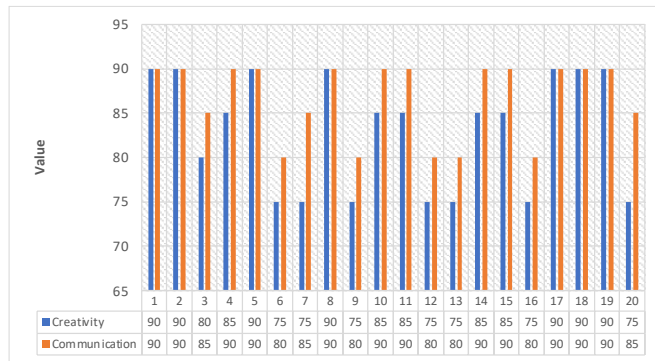


Figure 3. Student creativity and communication skills scores

Creativity and communication skills are two competencies that students in the 21st century should have (Chattopadhyaya & Biswas, 2021). Creativity is a student's competency in generating original ideas, producing original work and actions, and having flexibility in thinking in finding alternative solutions to problems. Meanwhile, communication skills are students' competence in answering questions, communicating ideas with symbols or tables, and the ability to work together in groups.

The development of these two competencies can not only be done in face-to-face lectures, but can also be done online (Pratama et al., 2020). Learning media that can be used in online learning include LMS, Google Meet, and PhET interactive simulations. The combination of these three media has been proven to be able to develop creativity and communication skills well.

There are various obstacles in implementing online lectures, including signal problems or poor internet networks, and electricity network problems. Social interactions between students and students and students and lecturers also cannot run optimally. Apart from that, the availability of electronic devices also influences the effectiveness of lectures in online mode (Singh & Meena, 2022).

## Conclusion

The application of LMS through SPADA University of Mataram, Google Meet, and PhET simulations has been able to develop student creativity with B+ criteria

and student communication skills with A criteria. LMS, Google Meet, and PhET interactive simulations can be an alternative in developing creativity and communication skills, especially in online lectures in the Independent Student Exchange (ISE) program.

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## Author Contributions

The head of the writing team acts as a lecturer, collecting data, data analysis, and discussion. Team 1 members played a role in creating student creativity instruments. Team 2 members created an instrument for student communication skills.

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## Conflicts of Interest

The authors declare no conflict of interest.

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