

# Development of Collaborative Online Learning Model Based on Case Method in Optics Courses to Train Creative and Communication Skills

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**Abstract:** Learning models really need to be developed to meet the demands of the world of work and keep up with existing technological developments, especially in the field of physics. This study aims to produce a collaborative online learning model based on the case method in optics courses. This research uses the Research and Development (R&D) method with the ADDIE model. The ADDIE model has five steps that need to be carried out in a structured manner because they are systematic, namely analysis, design, development, implementation and evaluation. The number of participants in this research consisted of 12 physics education students from Uhamka Jakarta and 13 physics education students from Unismuh Makassar. The number of lecturers involved was 5 people, with details of 3 from Unismuh Makassar lecturers and 2 from Uhamka Jakarta lecturers, all participants, both lecturers and students, carried out activities in the collaborative LMS that had been developed previously. The based on the process of implementing a collaborative online learning program. The analysis stage is the first step which aims to match the learning outcomes with the type or form of the digital module in the Optics course chosen. The design stage is to organize and design learning activities and videos. The development stage is the stage of building digital modules by assembling them into SPADA Unismuh Makassar. The number of students in the high improvement category in creative skills is 50% and in written communication skills is 60%. This shows that the use of collaborative online learning design in optics lecture activities related to geometric optics material has moderate effectiveness in improving creative thinking and communicative skills.

**Keywords:** Case method; Collaborative online learning; Communication skills; Creative skills

## Introduction

The 21st century skills are recognized as competency standards that students must have to

support success in their career or life in the future (Budi et al., 2021). Educational processes that need to be prepared for 21st century learning. The desired competencies in the 21st era are critical thinking,

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cooperative communication and creativity (Tohani & Aulia, 2022). Currently, a gap is found between the ideal demands for competency that student teacher candidates must have and the reality on the ground regarding the state of 21st century skill competency that student physics teacher candidates possess (González-salamanca et al., 2020). The ideal requirement is for prospective physics teacher students to master high-level thinking skills such as critical thinking skills, creative thinking and problem solving, as well as communication skills and ICT literacy, but in reality the majority of prospective Physics teacher students have high-level thinking, scientific communication and argumentation skills. still relatively low (Suliyannah et al., 2021).

The results of observations on the state of collaborative communication skills of prospective physics teacher students at one of the state universities in South Sulawesi which contracts for Optics courses by giving written communication skills tests with multi-representation aspects in an essay test format show that the majority of prospective Physics teacher students are at the level of low skills, only a small number of them have skills at a medium level. This is a big problem that must be addressed immediately (Ma’ruf et al., 2020). If it is not handled immediately, the competency targets that students must have as set out in the Indonesian national qualifications framework, especially those related to communication skills, will not be achieved properly (Ruf Ma’ruf & Dhiqfaini Sultan, 2023).

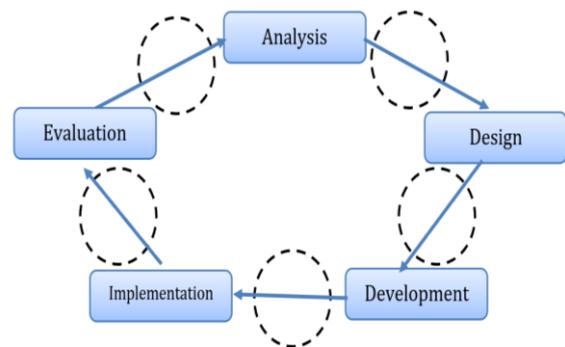
The use of a collaborative Case Method-based learning approach that is integrated into online learning activities is seen as an appropriate method because its use can improve scientific communication skills and other skills, as well as understanding concepts (Ma’ruf, Setiawan, et al., 2019). This is achieved through the use of learning materials and student worksheets which are oriented towards a collaborative case method approach. Physics learning activities that are integrated with the collaborative case method approach in learning have an impact on students' self-confidence in physics performance and competence, so it is important to involve collaborative online learning activities that not only aim to increase students' self-confidence and performance competence but also student interest, especially for previously less interested, became more interested and liked physics lessons (Sulistyaningsih & Eko Sujarwanto, 2023). The case method learning model is an alternative learning model that emphasizes problem solving from learning cases that are presented and solved collaboratively. The case method learning method gives students the opportunity to develop their potential or abilities by finding solutions to the cases discussed. This makes it a challenge for every student, of course. Students on their own initiative search for the

information needed to solve a case problem (Dunleavy et al., 2022).

The importance of this research is because it is able to facilitate the needs of students to develop creativity, capacity, personality and independence in developing personal insight and competence through real experiences and field dynamics such as ability requirements, real problems, social interactions, collaboration, self-management, performance demands, targets and achievements. This research also strongly supports the learning needs of physics students to become true learners who are more flexible and adaptive in facing the challenges of their time, without being uprooted from the roots of the Indonesian nation's culture (Khoiri et al., 2023).

**Method**

In this research, the Research and Development (R&D) method was used. R&D is a research method that aims to produce certain products and test their effectiveness. The product whose effectiveness was tested in this research was a digital optical learning module using a collaborative case method approach. R&D is a method used to develop products and test their effectiveness. The research model used follows the ADDIE model. The ADDIE model is a model that uses systematic design. The ADDIE model has five steps that need to be carried out in a structured manner because they are systematic, namely analysis, design, development, implementation and evaluation shown in Figure 1.



**Figure 1.** The R&D Research Design uses a ADDIE model

The first stage is analysis, in this stage the analysis is carried out starting from the analysis of student characteristics, analysis of the material being taught, and the competencies that will be conveyed. From this needs analysis, you can create hypotheses and determine the development of digital teaching modules to be carried out. Next is the design stage, from the needs analysis you can start designing digital teaching modules, for whom the development is designed, what kind of material will

be taught. The development stage is the third stage of the ADDIE development model. In this stage, the design created will be realized in the form of a collaborative digital module. The results of product development will be implemented or applied in learning. The final stage of the ADDIE development model is evaluation. At this stage, data is collected from the beginning of the development process to implementation. The data collected is data carried out at each stage which is used to improve and at the end of the program a summative evaluation is carried out to determine its effect on creative abilities and collaborative scientific communication and the quality of learning in general.

The number of participants in this research consisted of 12 physics education students from Uhamka Jakarta and 13 physics education students from Unismuh Makassar. The number of lecturers involved was 5 people, with details of 3 from Unismuh Makassar lecturers and 2 from Uhamka Jakarta lecturers, all participants, both lecturers and students, carried out activities in the collaborative LMS that had been developed previously. The reason for choosing students from these two campuses is because both of them are involved in collaborative online learning for optics courses. The physics education study program at Muhammadiyah University of Makassar is the implementer of the collaborative online learning activity program and the Uhamka Jakarta physics education study program is the activity partner.

In order to obtain complete data and for the sake of sharp data analysis, a research instrument was used, namely the expert judgment sheet, which is an expert validation sheet for the field of physics learning expertise and teaching module expertise. Creative skills test and scientific collaborative communication skills test.

Evaluation of the effectiveness of collaborative digital modules in optics learning, to train students' creative thinking and collaborative scientific communication skills through conducting pre-tests and post-tests. The results obtained from the pre-test and post-test are used to determine the level of creative thinking and scientific collaborative communication abilities based on the calculated N-Gain score. Comparison of pre-test and post-test results is calculated using the N-Gain score. The N-Gain equation is as follows:

$$N - gain = < g \geq \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}} \tag{1}$$

The results of the N-Gain average calculation were then interpreted using the criteria listed in Table 1.

**Table 1.** Division of Gain Score

<g>	Category
< g > ≥ 0,7	High-g
0,3 ≤ < g > ≤ 0,7	Medium-g
< g > < 0,3	Low-g

**Result and Discussion**

*Analysis*

Since the Covid19 pandemic hit Indonesia, it has also had an impact on the Physics Education Study Program at Muhammadiyah University of Makassar, namely that the learning process has shifted to online learning using the Unismuh Makassar online learning system. so that the Study Program's efforts to develop online learning were highly responded to by other lecturers. At the end of 2021 the physics education study program has started to develop semester learning plans based on Case Method. However, it still needs further updates and improvements.

Based on the problems above, physics education study programs need to make efforts to realize competency and strengthen student capabilities through distance learning facilities, namely by implementing collaborative online learning programs, which assist in developing content management systems, learning management systems, social media, and correspondence technology as learning and learning technology in the physics education study program at Universitas Muhammadiyah Makassar and collaborate with physics education study program at Universitas Prof. Dr. Hamka Jakarta.

*Design*

Designing asynchronous learning activities, students follow the learning process in groups via the internet but at different times with delayed feedback. For example, students discuss something in groups via email, bulletin boards, discussion forums and so on. Designing synchronous learning activities, students take part in the learning process in groups at the same time. For example, a group of students discussing something by chatting or audio-conference or video conference.

Choose the type of learning resources and activity sources. After analyzing the learning outcomes in the optics courses which are planned in the online learning system and continuing with the analysis of teaching materials, the design stage is then carried out through the following process: 1) media concept, which is based on mapping course topics to the curriculum structure and Digital Content by means of classifying teaching materials to determine their suitability for teaching in conventional face-to-face learning or learning using a learning management system. 2) the concept of communication, namely the selection and description of

communication media used in online learning, one of the determining factors for the continuity of the learning process is communication, communication that can be carried out, namely: synchronously and asynchronously. 3) Independent learning in the network. Students take part in the learning process delivered via the network, both individually and/or in groups. 4) Individual or group learning synchronously. Students take part in the learning process in groups at the same time. 5) Individual/group learning asynchronously. Students take part in the learning process in groups via the internet but at different times with delayed feedback.

Assignment submission is a source of measuring student learning activities through assignment submissions, of course the lecturer first prepares the assignments given to students. Every assignment submitted by students and lecturers provides grades and feedback. Chat is a source of measuring student learning activities in the form of chats between lecturers and students or between students and other students. This form of chat can take place synchronously or asynchronously.

Discussion Forums are a source of measuring student learning activities in the form of discussions between lecturers and students or students and students responding to each other's problems raised by lecturers and students. The asynchronous form of discussion is a discussion that takes place over a certain period of time. various forms of measuring student activities in the learning process using other e-learning media in the form of glossary, group choice, HotPot, Jelic, Journal lesson questionnaire, quiz, quizventure, realtime quiz, scheduler, SCORM package, simple certificate, subcourse, survey, Wiki, and form a workshop (Andari et al., 2021).

The evaluation concept is that various types of bills are used in learning assessments, including: quizzes, exams, individual assignments, group assignments, mid-semester exams, final semester exams, work reports and so on. Evaluation aims to provide input to decision makers in order to improve the quality, performance or productivity of an institution in implementing its program. Assessment in online learning is an assessment process carried out by lecturers to assess the learning process and outcomes of students who study through online learning. There are three important assessment activities carried out by lecturers during online learning, namely: 1) Assessments carried out by students themselves through independent assessments, 2) Assessments carried out to measure student learning processes and outcomes which are carried out after the learning process is complete, and 3) Processing scores assessment results to determine the final course grade. The final course grade is determined from components

such as student activities during online learning, assignment grades, mid-semester exam grades, and final semester exam scores.

#### *Development*

Learning with the application concept using e-learning media is basically the same as conventional face-to-face learning, but the form of implementation that is not directly simultaneous between lecturers and students or students and other students is one of the most striking differences. However, a learning model using e-learning media will encourage students to carry out independent learning so that it is more accurate to say that online learning is student-centered learning. As student-centered learning, it is best that learning support components such as teaching materials, media, assessment instruments should encourage and strive to be like learning in face-to-face classes.

In general, the conventional form of face-to-face learning is that the learning process occurs by interaction between lecturers and students, students and other students, as well as student interactions with learning resources, and with various other forms of learning activities such as doing assignments, discussions, evaluations and so on (Maruf & Dhiqfaini, 2021). Meanwhile, learning using e-learning media also occurs, namely the learning process by interacting independently with various teaching resources that have been uploaded by the lecturer and activities through discussions via forums, question and answer using the chat model, submitting assignments via assignments, holding evaluation activities.

Development and implementation of an online semester learning plan through a learning management system, with cross-disciplinary material and the application of assessment weights from the implementation of student-centered learning. At this stage, the course lecturer as a team prepares an online semester learning plan for the physics education study program at Universitas Muhammadiyah Makassar, which is structured based on the 2023-2024 physics education study program curriculum reference.

Development of online Optics courses for student exchange between the Unismuh Makassar Physics Education Study Program and the Uhamka Physics Education Study Program, namely by using the Learning Management System. The e-learning display at Muhammadiyah University of Makassar is in accordance with Figure 1.



Figure 1. Display of online learning with Spada Unismuh

The following are various learning support media that can be designed by the program implementation team to support the implementation of learning using e-learning media, which are classified based on teaching sources and forms of student activity.

Activity sources are meaningful instructional units or in other words conceptually something that must be done by students during the learning process. Therefore, a learning activity resource is defined as providing learning resources with various learning features to students.

**Implementation**

The entire contents of the digital module for the Optics course are stored at SPADA Unismuh Makassar, which is designed with the following structure.

Course description at the beginning of the optics learning resources page, it is explained about course identity, opening greetings, brief description of the course, learning outcomes, study instructions, scoring system, lecture rules, Concept map, lecturer identity (Villar et al., 2022).



Figure 2. Optical collaborative learning video display

Teaching material content based on student learning stages. Each main study material above is arranged with a structure, namely the initial part of the

main study material, consisting of: Opening greetings, brief description of the main study material, sub learning outcomes (Dunleavy et al., 2022). The content section is the presentation of teaching materials/materials, in the form of several features, such as: Pages (images, infographics, list of notations/symbols), document files (word, pdf, ppt, etc.), learning videos/simulations, URLs (teaching material links), summary (Hung et al., 2016).

The final part is the presentation of learning activity features to measure student learning experiences, such as discussion forums, quizzes, assignments, tests, feedback, reflection.

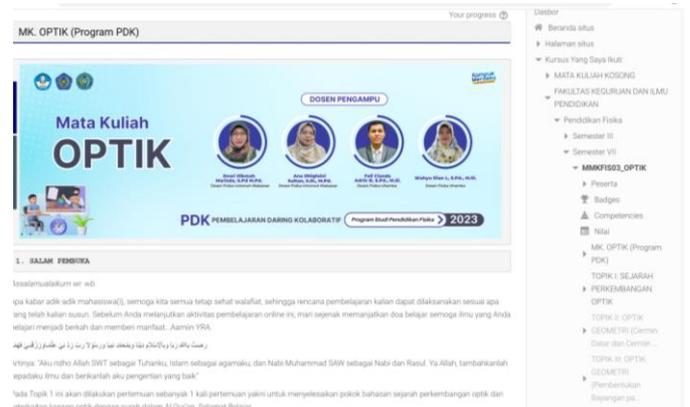


Figure 3. Display of online learning optics with Spada Unismuh

Improving Creative Thinking and Communication Skills in Limited Trials The collaborative online learning model can be seen in the Table 2.

**Table 2.** Increased Creative and Communication Skills Related to Geometric Optics Material Achieved by Physics Students

Skills	Average <g>	Category
Creative	0.56	Medium
Communication	0.62	Medium

Table 2 shows a recapitulation of data on the increase in creative thinking and communication skills achieved by physics students who were the subject of a collaborative online learning model trial on a limited scale regarding the topic of geometric optics.

In Table 2 it appears that the average increase in creative thinking skills was 0.56, and communication skills were 0.62, all of which are classified as moderate increases. This shows that collaborative online learning design has quite good potential for use in optical learning activities, especially on the topic of geometric optics which is able to train creative and communication skills well.

**Table 3.** Percentage of students in each category improving creative thinking and communicative skills related to the topic of geometric optics.

Gain categories are normalized <g>	Creative Skills	Communication Skills
High	50 %	60 %
Medium	30 %	25 %
Low	20 %	15 %

In Table 3 it appears that the number of students in the high improvement category in creative skills is 50% and in written communication skills is 60%. This shows that the use of collaborative online learning design in optics lecture activities related to geometric optics material has moderate effectiveness in improving creative thinking and communicative skills.

This study is also in line with other studies whose results are that the case method is able to reduce the gap between theory and practice, is able to provide complex and contextual learning experiences so that in case method learning, case articles are presented to help students relate the phenomena that occur and are discussed in discussion activities based on observation results and student perspectives, so that students not only memorize content but can also find out the relationship between the material taught and real-world situations (Dhiqfaini Sultan et al., 2023). Students are able to develop critical thinking skills, creativity and communication skills, increase student enthusiasm and motivation, the ability to communicate ideas, and the ability to work together with fellow group members so that a democratic atmosphere is created and mutual respect for the opinions of others (Ma'ruf et al., 2020).

#### *Evaluation*

Even though the results of the implementation of collaborative online learning on a limited scale have resulted in quite satisfactory improvements in creative thinking and communicative skills, the improvements have not yet reached the targets that have been set, the percentage of students who reach the high improvement category is still below 75%, which indicates that the use of collaborative online learning design in optics lectures has moderate effectiveness. For this reason, it is necessary to improve and perfect the collaborative online learning design, especially on elements that are deemed to still need to be strengthened so that the achievement of improving creative and communicative thinking skills becomes more optimal and has high effectiveness.

Based on the results of this implementation, further improvements were made to the collaborative online learning design, especially improvements to the case method section by adding alternative problem solving to real world problems and the addition of one stage to

collaborative online learning activities where students were asked to choose a solution that was considered the most appropriate. a number of alternative problem solving solutions are provided (Marisda & Ma'Ruf, 2021). This addition was proposed with the idea that when students are faced with various alternative problem solving solutions and students are asked to choose the one that is most profitable, then students are facilitated to build problem solving abilities (Yunus et al., 2021). In this process, students' abilities in terms of creative thinking and communicative skills can be built (Ma'ruf, Marisda, et al., 2019).

#### **Conclusion**

Based on the process of implementing a collaborative online learning program, the Physics Education Study Program at Muhammadiyah University of Makassar with the Physics Education Study Program at Muhammadiyah University, Prof. Dr. Hamka concluded that the process of implementing collaborative online learning programs generally goes through three stages, namely: 1) analysis stage, 2) design stage, and 3) development stage. The analysis stage is the first step which aims to match the learning outcomes with the type or form of the digital module in the Optics course chosen. The design stage is to organize and design learning activities and videos. The development stage is the stage of building digital modules by assembling them into SPADA Unismuh Makassar. The number of students in the high improvement category in creative skills is 50% and in written communication skills is 60%. This shows that the use of collaborative online learning design in optics lecture activities related to geometric optics material has moderate effectiveness in improving creative thinking and communicative skills.

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#### **Author Contributions**

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#### **Conflicts of Interest**

No conflict interest

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