

## IMPROVING STUDENT INVOLVEMENT IN PHYSICS STATISTICS THROUGH E-TASK

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**Abstract:** The Open Educational Resources (OER) media is used in distance lectures in Statistical Physics to increase student learning resources. However, OER needs to support distance lectures optimally. Therefore, a case-based E-task is needed as an alternative solution. This study investigated the effect of using e-Task on student involvement in Statistical Physics lectures. This type of research is quasi-experimental. This research was conducted in semester 2021.2 at the Open University, involving a sample of students taking statistical physics courses in the Physics Education program. The data analysis technique used was the independent sample t-test, with the data being normally distributed and homogeneous. Based on the results of the independent sample t-test analysis above, it can be concluded that the experimental class has a higher score than the control class, namely the attendance percentage is 100, the discussion percentage is 80.8, and case-based e-task solving is 7.3. It shows that there is a significant difference between the experimental class and the control class. Thus the use of e-task can increase student involvement in Statistical Physics lectures.

**Keywords:** *Physics Education, Statistical Physics, Distance Learning, Learning Media*

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### INTRODUCTION

Technological developments are increasing rapidly, so they have entered the world of education. Conventional learning has transformed into distance learning [1]. Distance learning is increasingly popular because it significantly expands teaching and learning spaces and allows students to study in-depth tertiary materials and programs [2]. Distance learning emphasizes self-study. Independent learning is systematically organized in presenting learning material, providing guidance to students, and supervising the success of learning students [3].

In the distance learning process, there is no direct face-to-face contact between the instructor and the learner. Communication occurs in two directions bridged by media such as computers, television, radio, telephone, internet, video, and so on [4]. The characteristics of distance learning are that there is an organization that regulates independent learning methods, learning material is delivered through the media, and there is no direct contact between the instructor and the learner, in line with the opinion of Mackenzie, Christensen, and Rigby who stated that distance education (PJJ) is a learning method that uses correspondence as a tool to communicate between students and teachers. Correspondence is a learning method using correspondence to communicate between students and teachers. Its characteristics include students and teachers working separately, but both are united by correspondence [5].

Following the characteristics of distance learning, the existence of separation or distance is overcome through the use of technology as a learning medium which is designed in such a way as to be able to teach students to learn with

relatively little assistance from the lecturer to present a series of learning materials. Learning materials must achieve the expected competency goals [6]. Distance learning can be planned elsewhere or outside the teaching place. Therefore, special techniques are needed in designing learning materials, special learning techniques, special communication methodologies through various media, and special organizational and administrative arrangements [5].

Distance learning has a new meaning with the development of technology and information. The existence of distance learning depends on learning media which constantly changes along with technological developments. Technology provides a new color in distance learning, starting with printed materials and audio cassettes, then switching to video media, and now developing with the use of computers and the internet, significantly impacting distance learning [6]. Open sharing will speed up the development of new learning resources, stimulate internal improvement, innovation, and reuse and help the institution to keep good records of materials and their internal and external use [7]. Implementing online learning challenges educational actors, such as educators, students, and institutions, and even challenges the wider community, such as parents. In practice, educators must find ways to convey learning material still and be accepted easily by students. Likewise, students are required to be able to adjust to situations and conditions like today, one of which is mental readiness [8].

Distance education in the Physics study program is carried out synchronously and asynchronously. Distance education carried out synchronously is defined as interaction oriented to

real-time learning, facilitated directly by instructors, and is usually scheduled. Meanwhile, distance education is carried out asynchronously. Students independently and flexibly choose the time to interact with the material that has been provided [9]. The aim of learning Physics is to improve students' thinking skills, making them skilled in the cognitive and psychomotor fields and able to process thoughts systematically, objectively, and creatively. Distance learning itself aims to meet educational standards by utilizing information technology using computers or gadgets that connect students and teachers so that the teaching and learning process can continue to be carried out properly [10].

Previous research has shown that distance learning positively impacts learning outcomes. Still, on the other hand, various obstacles and constraints can affect the quality of education. Several technical issues hindering online learning include limited mastery of technology by teachers and students; lack of facilities and infrastructure; weak internet access; and the lack of fees for internet data [11]. Other research also shows that some students experience problems while lectures are conducted online. Distance learning has an impact on student lecture activities. This impact includes positive impacts and negative impacts. The positive impacts felt by students include: being able to study anywhere, making students more independent in finding additional lecture material, and making students more adept at using technology, especially long-distance communication technology. While the negative impact is: when studying, students are sometimes divided into focus between listening to lecturers' explanations or doing other work outside of lectures, and when conducting discussions, extra time is needed to gather opinions [12].

Physics is a field of science that focuses on studying the nature and phenomena of nature and the interactions therein, such as matter, energy, and changes in matter, both microscopic and macroscopic [13]. Statistical physics course is one of the Physics study program courses. This course is considered quite difficult and requires a lot of discussion activities. This course emphasizes students' independent ability to apply statistical concepts to physics problems [14].

Other research shows that distance learning and teaching Physics Statistics still uses applications such as WhatsApp, where activities are focused on discussion only [14], and learning resources for Physics Statistics courses are still made from print [15]. Lectures in Statistical Physics at the Open University use a distance learning model. The Open University (UT) is the only state university in Indonesia that fully implements Open and Long Distance Higher Education (PTTJJ) [16]. Therefore, efficient

learning resources with a broad scope are needed to answer the challenges of distance learning.

Open Educational Resources (OER) was chosen as one of the strategic models. OER is an effort to increase learning resources for students and provide a place to increase discussion activities. OER is the concept of providing learning, teaching, and research resources in the public domain or has been released under an intellectual property license, which allows free use for everyone in non-commercial use. These learning resources can be used either directly or indirectly through adaptation by the user community [17]. OER was defined to include Learning resources - courseware, content modules, learning objects, learner support, and assessment tools, online learning communities [18]. Open educational resources refer to accumulated digital assets that can be adjusted and provide benefits without restricting the possibilities for others to enjoy them [19]. Many students preferred using OER instead of traditional textbooks [20].

Students are divided into several groups and can choose case titles to be discussed. However, the use of OER is still not effective. Student activity still needs to improve, and many still need help understanding the material during lectures. Therefore we need an application that can help solve the problem. Case-based e-task was chosen as an effective solution to this problem. E-Task is an electronic assignment whose application is a media or tool for lecturers and students for the teaching-learning process that focuses on making student group assignments [21]. The advantage of the case-based E-Task application is that students can submit assignments from anywhere and at any time with a predetermined time limit. Besides that, it can increase knowledge and add insight to students in solving problems and using information technology [22]. Thus, this study aimed to investigate the effect of using e-Task on student involvement in Statistical Physics lectures.

## RESEARCH METHODS

This type of research is quasi-experimental by classifying classes into experimental and control. The experimental class is a class in a physics statistics course that uses case-based e-tasks in its system. At the same time, the control class is a class whose lectures use e-tasks without being case-based. The population of this study was students in semester 2021.2 at the Open University. The sample involved students who took statistical physics courses in the Physics Education program, totaling 20 people. The sampling technique used was purposive sampling. The data collection techniques in this study consisted of several types, namely, using an automatic observation system to see student involvement through the Open University e-learning application

and essay instruments in assessing student assignments in case-based e-task applications. The questions in the e-task were divided into three groups and presented in the third, fifth, and seventh sessions. The data analysis technique is the independent sample t-test, with normally distributed and homogeneous data.

**RESULTS AND DISCUSSION**

We can see the involvement of students in Statistical Physics lectures using e-Task from several aspects. In distance learning, e-Task

monitors student activities in carrying out case-based assignments. Assignments are divided into three topic groups. Figure 1 below shows a diagram of student activity in doing case-based assignments.

Figure 1 shows that 16 students did assignment 1, and 1 student did not do the assignment. For assignments 2 and 3, it was observed that 15 students did assignments while two students did not. E-task is also used to monitor student attendance. Figure 2 below shows a diagram of student attendance in Statistical Physics lectures.

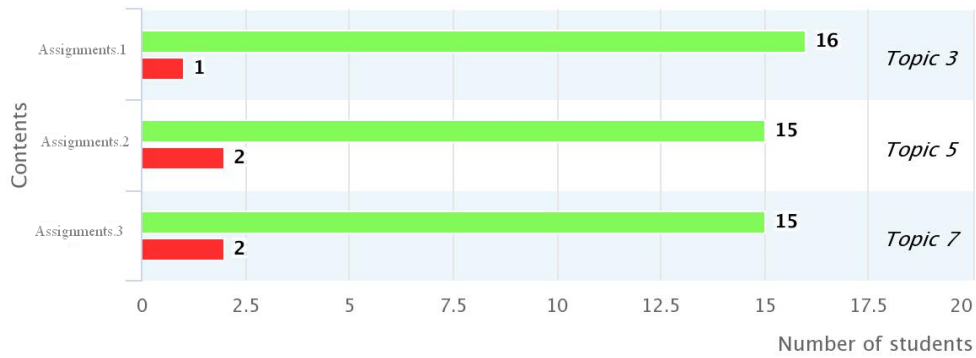


Figure 1. Student activities in working on Case-Based E-tasks

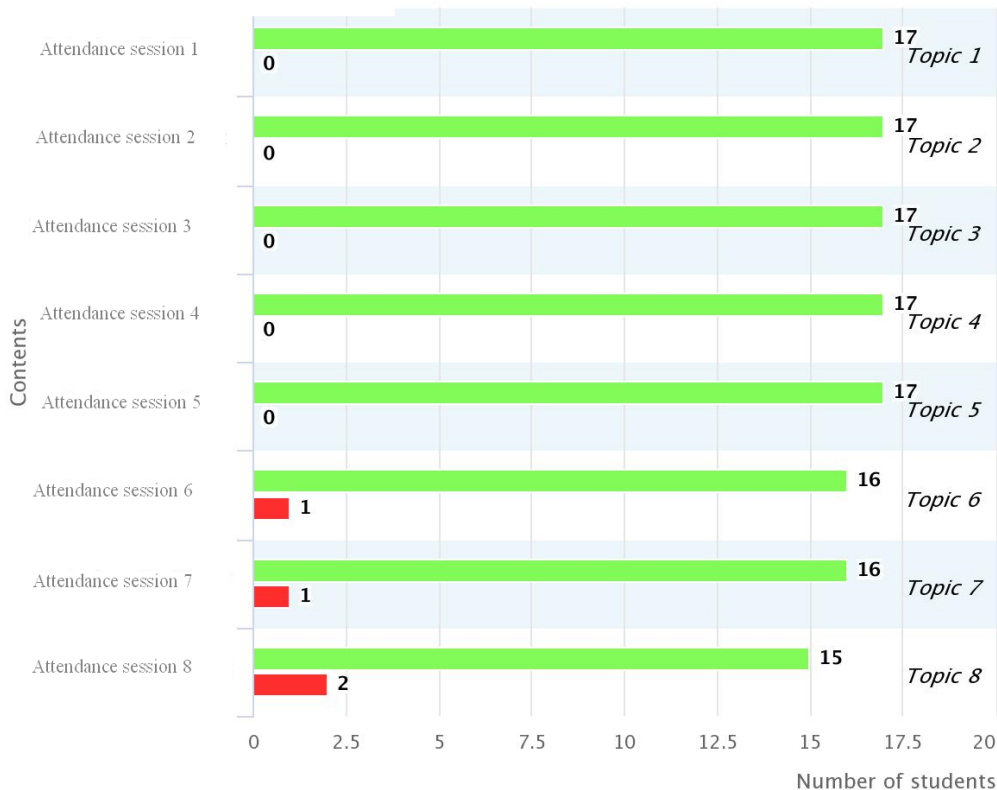


Figure 2. Graph of Student Absenteeism Distribution in Each Physics Lecture Session Using case-based E-tasks

Based on Figure 2, we can see students' attendance from the 1st session to the 8th session. From session 1 to session 5, no students were absent from taking part in the e-task, but in

sessions 6 and 7, there was one student who was not present, and in the 8th session, there were two students who were not present, taking part e-tasks.

Furthermore, through e-tasks, students can discuss with each other to find solutions to case-based problems given by lecturers. The discussion focused on student activity. During discussions, students are faced with a problem in the form of a statement or question that is problematic to discuss and solve together so that lecturers and students or students and other students exchange ideas and opinions with each other. The teacher carries out discussions to achieve at least three important

specific learning objectives, including a. Discussions improve students' thinking and build their understanding of lesson b. Discussions foster student involvement and participation c. Discussions can help students learn important communication skills and thought processes [23].

The display of the distribution diagram of student discussion activities in Statistics Physics lectures can be seen in Figure 3.

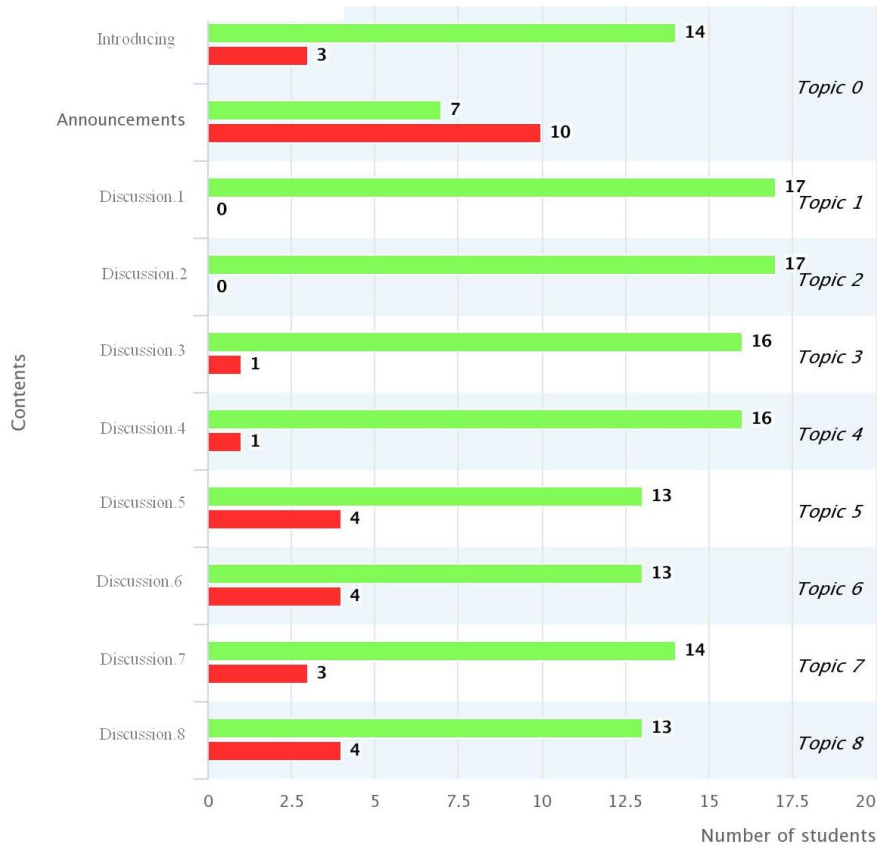


Figure 3. Distribution of Student Discussion Activities in Each Session of a Statistics Physics Lecture Using Case-Based E-Task

Figure 3 indicates that discussions are held at each lecture session with e-tasks. The number of students actively participating in the discussion was more than the number of passive ones. Even in sessions 1 and 2, all students actively participated in the discussion. Meanwhile, in other sessions, only 1.3 or 4 students did not actively participate in discussion activities.

Then an independent sample t-test analysis was carried out using SPSS, with normally distributed and homogeneous data in the experimental and control classes. The experimental class was given treatment in the form of using case-based e-tasks for eight sessions of Statistical Physics lectures, while the control class did not use case-based e-tasks. We can see the results of the independent sample t-test analysis in table 1 below.

Based on the independent sample t-test analysis results, there appears to be a significant

difference between the experimental and control classes. It shows that case-based e-tasks can increase student involvement in Statistical Physics lectures. Case-based e-tasks make it easier for students to discuss and submit assignments given by lecturers. Learning activities in tertiary institutions involve students actively interacting. Lecturers must be able to carry out learning oriented towards student activities in finding and establishing meaning independently so that the learning process will be able to develop higher-order thinking skills [24].

Traditionally distance education was limited in the number of people served because of production, reproduction, distribution, and communication costs. In the past, schools spent resources to produce a course and then additional resources to reproduce it and send it to students. The Open Educational Resources (OER) movement

is a technology-empowered effort to create and share educational content on a global level [25]. Educational resources in digital form can and should be made openly and freely available, contributing to a wider project of opening access to education [26]. OER facilitates distributed learning processes where resources can be dynamically adapted according to specific learner requirements and where learners can efficiently borrow cognitive capabilities from their social and technical environment [27].

Table 1. The average value of student activity in the experimental class in terms of various aspects

No	Assessment Aspects	E-task (Grade point average)	
		Case-Based	No case
1	Presence	100	95
2	Discussion	80.8	65.4
3	Case-based e-Task	75.3	60.2

Especially in distance learning, where the availability of technology to support lectures is needed. Distance learning has the advantage of advancing modern education. Distance learning provides a new, more challenging experience, is not limited by space and time, opens sources on the internet, makes teaching materials easily updated, and increases student independence. From the aspect of more flexible time, it is more accessible access to material, bringing up new experiences, and ease of evaluation. Online methods affect efficiency in terms of time, energy, and costs in certain respects compared to face-to-face or offline meetings [11]. The advantage of distance education is that lecturers and students can communicate easily and at any time without being limited by distance, time, and place. Online lectures can also improve students' skills in using communication and information technology [28]. OER would provide access to quality educational resources and opportunities for lifelong learning in the context of sustainable development [29].

## CONCLUSION

Based on the results of the independent sample t-test analysis above, it can be concluded that the experimental class has a higher score than the control class, namely the percentage of attendance is 100, the percentage of discussion is 80.8, and the case-based e-task solving is 7.3. It shows that there is a significant difference between the experimental class and the control class. Thus the use of e-tasks can increase student involvement in Statistical Physics lectures.

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