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E-MODULE-ASSISTED CONTEXTUAL TEACHING AND LEARNING (CTL) LEARNING MODEL IMPROVES STATISTICAL REASONING ABILITY

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Abstract

This research is conducted to describe a contextual teaching and learning (CTL) learning model assisted by e-modules in basic statistics lectures. This research needs to be carried out because the observation results state that in addition to utilizing references from textbooks, students want to teach materials in the form of worksheets with the following characteristics: (1) containing real contextual problems in student thinking; (2) the language is easy to understand; and (3) facilitate students in reinventing theoretical concepts of parameter estimation. Applying preferred reporting items is for systemic review and meta-analyses (PRISMA). This study used a similar assessment structure to the bibliometric research applied by previous studies. The journal obtained as many as 40 articles that have been published from 2018 to 2022. The results showed that learning the topic of estimating parameters would be more meaningful if lecturers could design learning models accompanied by E-modules that were adjusted to develop students' thinking abilities. One way is to use an authentic context close to the student. An approach that uses real context to facilitate students to create their models in finding the concept is Contextual Teaching and Learning, assisted by E-modules.

Keywords: Contextual Teaching and Learning, E-module, Statistical.

INTRODUCTION

The ability of statistical reasoning is essential in facing today's rapidly developing information and technology era [1], [2]. However, many students have difficulty in understanding statistical concepts due to their abstract and complex nature. Conventional learning models sometimes fail to address these challenges due to a lack of contextualization in learning. Therefore, the development of a learning approach that blends contextual learning theory with the use of technology such as e-modules is important [3], [4]. The e-module-assisted Contextual Teaching and Learning (CTL) learning model offers solutions by relating statistical concepts to students' real-life contexts. This not only increases students' understanding but also develops their ability to apply statistics in everyday life. Nonetheless, the implementation of this model faces challenges such as the availability of technological infrastructure, teacher training, and the development of e-module content that suits the curriculum and student needs. With this background understanding, research and implementation of e-module-assisted CTL models are expected to improve the effectiveness of statistical learning at all levels of education.

In addition, the importance of improving statistical reasoning skills is not only limited to academics, but is also very relevant in professional contexts and everyday life [5], [6]. In the world of work, the ability to analyze and interpret statistical data is a highly

sought-after skill by many companies. With advances in technology and digitization, data is becoming more abundant and complex, so the ability to process statistical data has become increasingly valuable [7]–[9]. In addition, in everyday life, statistical reasoning skills enable individuals to make more informed and rational decisions, both in managing personal finances, understanding information presented in the media, and in making decisions based on facts and evidence. Therefore, through contextual and technology-assisted learning approaches such as the e-module-assisted CTL model, it is expected to provide significant benefits in improving students' statistical reasoning skills, both in academic, professional, and daily life contexts.

In addition to the far-reaching benefits, improved statistical reasoning skills also have a significant impact in preparing students for standardized exams that often include statistical material [10]–[12]. With strong statistical reasoning skills, students will be better prepared to solve exam questions that require a deep understanding of statistical concepts. This not only impacts their academic performance but can also increase self-confidence and learning motivation. Thus, the implementation of e-module-assisted CTL models in statistical learning can be an effective strategy in improving student learning outcomes in the context of critical academic evaluation.

Learning has many strategies, one of which is the use of modules. Modules are defined as self-instructional learning tools that involve a foundation in learning [13], [14]. Modules are one of the systemized and structured learning resources that contain arranged learning, planned to support students in achieving learning objectives. The statement above can be stated that the module is a learning resource that can be used independently, arranged, systematized and can support students in the learning process.

Modules have distinctive features that make them unlike other forms of learning resources. The characteristics in question such as modules have a form of learning that can provide convenience in learning; (2) have a series of planned and systematic learning activities; (3) have clearly formulated learning objectives; (4) independence in learning; (5) individual recognition differentiation [15]–[18]. It can be said that the modules used can be adjusted to the needs of students so that students can increase interest in learning.

A contextual-focused module known as contextual teaching and learning (CTL). The foundation of CTL is defined as a learning process that connects learning content with students' daily lives [19]–[21]. CTL focuses [there is a learning foundation that can realize events that are in accordance with the facts in the classroom so that it can motivate students to understand the learning content and practice it in everyday life. The learning process can be done not only to provide knowledge from lecturers to students.

The application of CTL is presented in the form of material content that is around students, so that the learning process can be more effective. Learning activities are more meaningful if they provide learning content in accordance with student experience, so that students can know the benefits of learning content. The application of CTL can be done in learning to provide students with knowledge that can be implied to find solutions to a problem. The implications of CTL in class are not only carried out by students according to facts, but learning is carried out directly not from rote memorization alone.

CTL is an approach that can help educators relate learning material to students' real-world situations, and encourage them to make connections between the knowledge they have and its application in their daily lives [22]–[24]. In addition, the CTL approach is a learning process connected to real learning, so that students gain knowledge and skills that are implied in everyday life. In addition, the learning method in CTL focuses on the process of involving students in discovering learning content and connecting it with real circumstances so as to motivate students in implications in real life [25]–[27]. The CTL approach has distinctive features, such as connectedness. Experience, implications, cooperation, and self-order.

The essence of CTL is constructivism, discovery, learning, reflection, and evaluation. CTL is a trigger tool for students in carrying out activities. According to Johnson, in the daily life of students in the environment of personality, social, and culture. Students have difficulties in the learning process, such as statistical foundations explained by lecturers in class and not yet understood by students experiencing difficulties in learning basic statistics, student disinterest in learning basic statistics. The results of interviews with students and lecturers obtained information that students often forget the prerequisite material needed in learning theoretical concepts on the topic of concentration size. Lecturers have difficulty in applying contextual learning models in basic statistics lectures. Lecturers do not fully implement the syntax of the learning model in accordance with existing theories [28]–[30].

Based on observations in basic statistics lectures, there is another problem that often arises, namely the weak ability of students to use their thinking skills to solve mathematical problems. Students have a lot of knowledge and information at their disposal but it is difficult to relate to the situation they are facing. Learning resources that are still used in basic statistics lectures are in the form of printed books and power point media. The printed books used are still translations so they have not fostered students' interest in learning. The use of these two learning media is considered less efficient in terms of developing students' ability to reason [31]–[33].

In addition, student solving skills need to be developed and improved, so that students can develop their way of thinking and be able to solve various problems they face in learning. In the 21st century, problem-solving skills are skills that are needed through this skill students are able to group, organize, remember, conduct experiments, analyze information, and communicate both orally and in writing. The following is the data from the results of student problem-solving ability tests in Basic Statistics lectures at Padang State University and Hatta University.

Table 1: Student Problem Solving Ability Test at Padang State University and Hatta University

College Name	Complete		Incomplete	
	Sum	Percentage	Sum	Percentage
PGRI, West Sumatra University	10	35,71	18	64,29
Hatta University	9	39,13	14	60,87

Another problem found from the analysis of lecturer questionnaires is that generally lecturers still like to use books rather than teaching materials that they compile themselves such as student worksheets but books have not fully been able to guide students to learn actively and creatively. This problem is also one of the causes of lecturers' difficulties in applying model syntax. In the application of this model, teaching materials that have characteristics are needed in accordance with the selected model.

Therefore, students must prepare in advance about the prerequisite material by repeating it, discussing with friends, or hoping that the lecturer reviews the prerequisite material at the beginning of learning [34]–[36].

Students feel that some of the material in the basic statistics course is difficult to understand because it requires reasoning skills. For this reason, students prefer learning that invites students to reason with various activities to find theoretical concepts in lectures, compared to lecturers explaining the material directly in detail. This is because the characteristics of students vary. If learning is carried out classically by following the explanation given by the lecturer, of course, not all students are able to analyze what the lecturer said. The theories directly explained by the lecturer did not last long in the minds of students [37]–[39].

Lecturers are expected to facilitate students to discuss each other by providing learning tools that help students retrace theoretical concepts. Students want that learning basic statistics is not only able to use standard procedures/steps, but the process of exploring theoretical concepts is much more important so that they can learn more meaningfully [40]–[42]. The results of interviews with students showed that in addition to utilizing references from textbooks, students wanted teaching materials in the form of worksheets with the characteristics: (1) containing real contextual problems in student thinking; (2) the language is easy to understand; and (3) facilitate students in rediscovering theoretical concepts.

METHOD

The study used preferred reporting items for systemic review and meta-analyses (PRISMA). This study used an assessment structure similar to bibliometric research applied by previous studies. The journal obtained as many as 40 articles that have been published from 2018 to 2022. The method of articles is collected using the PICO model which is part of the form of collecting literature studies obtained from articles from scientific journals. The study was carried out in an analysis entitled "Contextual Teaching and Learning (CTL) Learning Model assisted by E-Module in Basic Statistics Lectures Improving Statistical Reasoning Skills".

Search strategy and selection of relevant studies based on six electronic databases (google scholar, pubmed, elsavier, national index, science direct, web of science, and national index). The structure of the assessment applied in this study is similar to previous studies. Jumalh obtained 40 articles published from 2018 to 2022. The use of reference management iala mandeley, record-keeping that has been compiled, titles and filtering abstrka is carried out, and each text article is viewed based on criteria and inclusion.

The strategy of searching and selecting relevant studies is carried out based on review literature, namely articles on the E-Module-assisted Contextual Teaching and Learning (CTL) Learning Model in Basic Statistics Lectures: Preliminary Studies published from 2017 to 2022. The results of article inclusion obtained 40 articles then abstracted based on the theme of this study resulting in 10 articles that were assumed and assessed as complete text. The use of Mandeley reference management is carried out to compile, abstract based on the title of this article about the E-Module-assisted Contextual Teaching and Learning (CTL) Learning Model in Basic Statistics Lectures: Preliminary Studies.

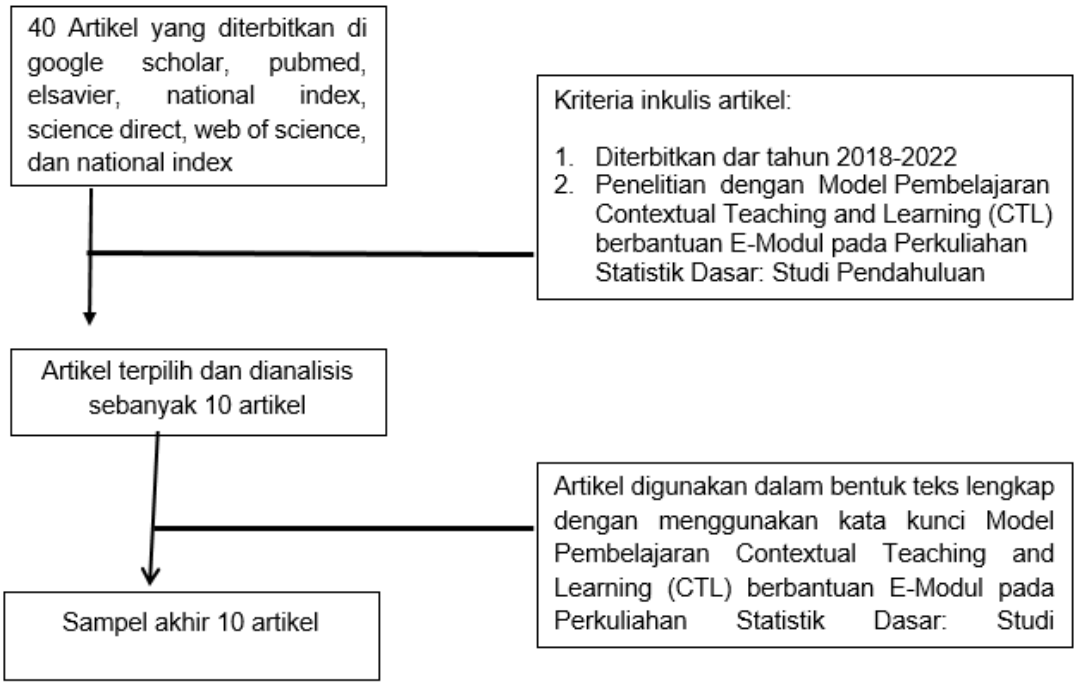

Figure 1: Research Design

RESULTS AND DISCUSSION

E-Module

The application of e-modules is a set of learning that is needed in learning and provides convenience to students and lecturers in providing learning content. Sofan and Ahmadi said that modules are a form used to assist lecturers in carrying out learning activities. The definition of modules according to Jasmadi is a medium made to achieve learning objectives [43]–[45]. Prastowo revealed that modules are media or information arranged in fulfilling the skills targeted by students in learning. The above opinion can be stated that the module is a learning medium that is structured and systematized as a source of learning in achieving the skills that have been planned [46]–[48]. The preparation of e-modules is carried out so that the availability of relevab e-modules with the curriculum and student needs; as an alternative to e-modil used by students and lecturers; and provide convenience to lecturers and students in learning. In addition, there are benefits in the preparation of e-modules, such as benefits for students, namely not dependence on package books so that they can rely on e-modules in learning, gaining knowledge, adding experience and knowledge in preparing modules. While the benefit for students is to make learning more interesting, independent in learning, making it easier for students to achieve competence [49]–[51]. Next, the advantages of e-modules are explained, such as making it easier for students to bring learning content resources, making it easier for students to learn according to their needs, and not requiring a special set in their use, making it easier for students to develop student competencies in the learning process by using good language, and the use of e-modules can be evaluated in improving the quality of e-modules. As for the disadvantages of e-modules, such as (a) Does not require a lot of cost and a long time; (b) in preparing the e-module requires a good team of expertise and competence and can work well together; (c) Students should be able to form discipline in the learning process [52]–[54].

Principles of E-module

The Directorate General of Primary and Secondary Education Management describes the unique characteristics of e-modules which are divided into.

a) The principle of connectedness. Learning content should be relevant to competency standards and basic competencies achieved, for example, competencies should be carried out by students in the form of conveying facts, learning content given to students in the form of reality in the field.

b) Consistency between the skills possessed by students, so the e-modules developed should speak the skills needed by students;

c) The scope of material content in the e-module can be adequate in order to support the achievement of learning competencies that have been formulated. The material in question has an impact on student learning [55]–[57].

E-module assisted CTL model development

E-modules are provided for achievement in fulfilling previously planned learning objectives. E-modules were developed to support lecturers in providing learning content. There are a number of e-module developments, namely if the availability of materials, selection of discussion and if lecturers do not get e-modules relevant to the learning content. The development of e-modules includes analysis of e-module needs, preparation of e-module roadmap, application of e-modules, and assessment [58]–[60].

Contextual Teaching and Learning (CTL)

Contextual learning is an effort to make students active in improving skills because students can know the foundation and apply it in real life. The word contextual comes from the word context which means the relationship between context and CTL learning conditions. Johnson stated that contextual learning is a systematic activity that can motivate students' thinking to formulate patterns that are realized with meaning. Johnson also stated that contextual learning is learning that is relevant to students' thoughts and produces meanings that are related to academic coverage with the context of students' daily lives [61]–[63]. Contextual learning is the essence of learning that can be connected between learning content and student learning conditions and environments and motivate them in their daily lives. The results of the description above can be said that contextual learning is learning that is connected to learning content with students' daily lives with learning achievements for finding the meaning of learning content in their daily lives [64], [65].

The Nature of Contestual Learning

Syahza described that the contextual learning approach has 7 contextual learning principles that can be applied by lecturers [66], [67], namely,

a) Constructivism is a philosophical foundation in CTL learning, namely knowledge created by humans whose success becomes limited in terms of context.

b) Inquiry is a CTL activity with discovery efforts that can provide assertion that knowledge and other skills are needed as a medium for searching for reality in the field.

c) Giving questions, The knowledge possessed by individuals begins with giving questions. To provide questions in CTl can be done by lecturers, habituation carried out by students in giving questions or the ability of lecturers to ask good questions to encourage the quality of learning.

d) Learning community, Habituation for students to collaborate and empower learning resources from classmates. In the learning community states that learning is carried out by sharing experiences. Through sharing experiences, it can provide habituation to other students to depend on positive things [68], [69].

e) Pilot, Pilot model can be done with learning development so that students can meet expectations.

f) f. Reflection, Reflection is a thought about an event that has just been given by the lecturer. It can be said that reflection is the thought of students in studying, identifying, understanding and discussing by the students themselves.

g) g. Evaluation, The last activity based on contextual learning is assessment. Assessment is the process of collecting information that describes the student's learning experience [70], [71].

Pros of CTL Approach

a) Learning has meaning. In other words, students are expected to be able to connect the nature of learning with the situation at school.

b) Learning is more effective if it can increase student knowledge because CTL learning has elements of constructivism so that students can know so that students can carry out learning according to their experience.

c) Learning content can be obtained by students and not only from lecturers.

d) The implementation of CTL learning can make classroom learning better.

Disadvantages of the CTL approach

a) It takes a long time through the use of CTL approach in the learning process.

b) An ineffective situation, if the lecturer has not been able to control the class properly.

c) Lecturers have intensity in providing guidance because CTL is centered on obtaining information. Lecturers are responsible for controlling classes to collaborate in gaining knowledge and skills for students [72], [73].

Based on the explanation above, it can be said that the results of curriculum analysis that the learning outcomes in the basic statistics course are that students have the ability to master theoretical concepts and are skilled in using them in solving problems. This means that studying topics in basic statistics courses is not just about being able to solve problems using standard procedures, but students must be able to master and understand these theoretical concepts in depth. If students only memorize standard procedures without understanding the underlying meaning or logic then curriculum objectives will not be achieved [74], [75].

In order for topic learning to achieve curriculum objectives, it is necessary to examine the essential concepts that need to be present in basic statistics courses. In addition, students must have adequate knowledge of the prerequisite material needed in learning basic statistics [76], [77].

The prerequisite material is in the form of concepts about population and samples, parameters and statistics, measures of concentration and measures of diversity, the concept of chances, opportunity histograms, and several distribution of opportunities (such as binomial distributions and normal distributions) [78], [79].

Based on the material obtained from the results of concept analysis, it is obtained that the essential concepts that need to exist in learning basic statistics are: statistical size and sampling distribution for the mean. Through concept analysis and strengthened through interviews and discussions with the team of course lecturers, a network of essential concepts was obtained to learn basic statistics.

The network of essential concepts begins by constructing the concept of sampling distribution. This is because the concept is based on the sampling process. Because the samples obtained between experiments are not all the same, the sampling average will form a certain distribution. Measures obtained from samples in the form of statistics, will be used to estimate parameters as a characteristic of the population.

The results of the literature review show that in general the literature focuses more on the steps to solve the problem. The sampling distribution material and statistical measures are presented in separate chapters, and there is no visible exposure of their relationship with a material [80], [81].

The systematics of the material presented in the literature is less able to facilitate students to retrace theoretical concepts in depth, because these literatures generally explain in detail accompanied by sample questions for each theoretical concept described, so that students' problem-solving abilities are less able to be improved. Students are not given space to make their own strategies in finding theoretical concepts [82], [83].

So, associated with theoretical studies, basic statistics learning will be more meaningful if lecturers are able to design learning models accompanied by E-modules that are adjusted to the development of students' thinking skills. One way is to use real context that is very close to students. An approach that uses real context to facilitate students to create their own models in finding concepts is Contextual Teaching and Learning assisted by E-modules [84]–[86].

CTL is an approach that can help educators relate learning material to students' real-world situations, and encourage them to make connections between the knowledge they have and its application in their daily lives. Furthermore, CTL is also an approach to learning that has been proven to develop students' problem-solving abilities through critical and creative thinking processes through providing real-world problems. CTL can facilitate educators to foster student motivation in learning mathematics, especially in solving real-world problems [87]–[89].

CONCLUSION

The results of the study concluded that learning basic statistics will be more meaningful if lecturers are able to design learning models accompanied by E-modules that are adjusted to the development of students' thinking skills. One way is to use real context that is very close to students. An approach that uses real context to facilitate students to create their own models in finding concepts and improving statistical reasoning skills is Contextual Teaching and Learning assisted by E-modules.

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