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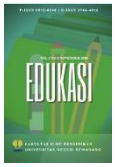

HOTS Question Analysis on E-Learning: a 21st Century Competency Evaluation

Ami Hibatul Jameel[1], Abd Gafur[2], Andy Sapta[3]

[1,2,3]Faculty of Educaton and Teacher Training, Universitas Terbuka, Indonesia

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Abstract

The development in the 21st century brings changes in the education field. Universities, in this case, must also be able to produce graduates who are expected to be able to answer future challenges and be globally competitive. One way to succeed in 21st-century competencies and accommodate digital native learners is to integrate digital literacy and take advantage of assignments in the Universitas Terbuka e-learning. The questions on e-learning assignments should also raise students' critical thinking and creative thinking skills. However, do the existing tutorial assignments lead to higher order thinking skills (HOTS) or are they still at the level of lower thinking skills? This study aims to analyze tutorial assignments in UT e-learning to improve 21st-century competencies (critical thinking skills and creative thinking skills) among UT students, especially Educational Technology Study Program in the Faculty of Teacher Training and Educational Sciences. The research was conducted using a mixed method, qualitative and quantitative research approach. Data was collected by using the document analysis technique which was then processed and analyzed qualitatively and quantitatively. After doing the analysis, the research results show that the tutorial assignments have yet to lead to higher order thinking skills (HOTS). This result leads to the recommendation that the learning experience should become ownership for the students so that students could be more attached and eager to learn and do the assignments.

*Correspondence:
E-mail: ami.jameel@ecampus.ut.ac.id

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INTRODUCTION

The 21st century, also known as the era of disruption, is a century where significant changes occur in various aspects of life, including education. Many jobs that exist today have never existed before, making education very important to prepare future generations to compete globally. Education, especially in higher education, is also a milestone for change because it will produce graduates who are expected to create new opportunities and adapt to changes. Universities are required to prepare globally competitive graduates. Universitas Terbuka (UT), in this case is also a university in the 21st century era that is also transforming and has the vision to become a world-class university. This vision also needs support from all aspects of university, including the quality of students.

Students at Universitas Terbuka (UT) have their uniqueness because they consist of different backgrounds, such as in terms of geography, economic and social background as well as significant age differences. UT students, especially in Educational Technology study program are mostly adult workers. Their attempt to study in higher education can originate from individual needs to fully develop themselves to enhance intelligence or a cultured mind, or it can also be generated by their social role as workers in their workplaces or organizations (Suryana, 2019; Shofwan, et. al., 2021).

Entering the digital era, students must also become experts in using various supporting technologies for the learning system at Universitas Terbuka. Prensky (2001) states that the current generation of students is no longer suitable to be taught with the previous education system. Many students become digital natives because they have been exposed to technology from an early age. Changes in students also change learning and learning designers are also required to redesign learning that not only facilitates students with digital natives but also provides skills to master.

Students must use their full potential by developing several skills and knowledge including problem-solving, critical thinking, communication and collaboration, also known as "21st century competencies" (Pellegrino & Hilton, 2013). To cope with the demands of the 21st century, students, in this case, students, need to master more than just knowledge in lectures. It is very important for students to be able to use their knowledge by thinking critically, applying it in various situations, analyzing and generating new ideas. Critical thinking, problem-solving, and collaboration are important skills a student has to succeed in this rapidly developing world. The same opinion is expressed by Buckingham Shum & Deakin Crick (2016) that the strategy to respond to the world with all its changes is to focus on training skills, and authentic assessments that will equip learners with new and complex situations.

Education at the University level across all disciplinary expertise aims to produce students' thinking skills that represent the principles and practices of scientific research. Graduates from university are supposed to use their higher order thinking skills for their future careers to solve the complex problem in present times, whereas those thinking skills are also essential at higher levels of academic study like in University (Cottrell, 2023; Murtonen & Salmento, 2019). Universitas Terbuka as an open university also aims to produce graduates that have high competitiveness. Universitas Terbuka e-learning is a Learning Management System (LMS) facility that can accommodate students to conduct distance learning (PJJ) and prepare them to be competent in their fields. LMS is a portal in the network that connects lecturers and students. LMS provides a place for learning materials or other activities, such as assignments and discussions that can be shared easily. The portal in this network also allows lecturers and students to interact outside of lecture hours (Adzharuddin, 2013). LMS at the Universitas Terbuka contains learning materials, discussion forums, and tutorial assignments. The LMS can also be traced to learning analytics (Learning Analytics), where the study program or organizer can measure, collect, analyze, and report data

about learners and their context to understand and optimize learning. (Dietz-Uhler & Hurn, 2013; Phil Long & Siemens, 2011).

The tutorial assignments in e-learning contain questions to determine the extent to which students have mastered the lecture material. However, tutorial assignments must be designed in such a way that they can accommodate students to think critically and think creatively. Conklin (2012) argues that critical thinking is a term many people use to associate with higher order thinking skills (HOTS). In a narrow sense, critical thinking is about careful analysis and judgment. Creative thinking also includes higher order thinking skills and is as important as critical thinking.

The 21st century competencies and the digital era make students experience situations where changes are constantly occurring (disruption era). This is a challenge to face global competition. For this reason, students need to be prepared to excel by mastering 21st century skills (critical thinking, creative thinking, and problem solving). Creating quality students who are ready to face various challenges requires preparation since they are still in university. A lot of research has been carried out in analyzing higher order thinking skills in school levels. Yuniar et al. (2015) analyze HOTS questions in an elementary level Social Studies objective test and find that from 20 questions, 14 of them are fulfilling the criteria of higher order thinking skills and 6 of them are not fulfilling the HOTS questions criteria. Another research conducted by Pratiwi (2022) analyze daily assessment in mathematics primary level. It is known from 20 items questions, 60% of them are included in the HOTS questions type while the rest 40% are still in the lower order thinking skills (LOTS) questions type. Suci & Aris (2021) analyze two Science books in junior high level and compare both the material and question type. In the first book, only 41% of materials and questions are HOTS, while in the second book only 20% of materials and questions are HOTS. Another research is done on English subject in senior high level by Laili et al. (2020). From three schools of research subject, all daily exam questions developed by teachers are still LOTS questions (C1, C2, and C3 level) and none of the questions are HOTS questions. Thus, this research shows that teachers still need guidance in developing HOTS questions. Another HOTS research was done by Lu et al. (2021), who analyzed 217 university-level students in a smart classroom environment. Students completed a survey to measure their learning preferences on peer interaction, learning strategy, learning motivation, and smart classrooms towards HOTS. The result indicates that peer interaction and learning motivation directly impact students' HOTS. Those findings show results of research at school levels and in conventional university level. However, research in open and distance education has not been taken yet. Hence, analyzing higher order thinking skills at university level especially in an open and distance education is imperative.

Universitas Terbuka as a pioneer of distance universities prepares students in this digital era, one of which is online learning using the e-learning platform. Online learning is considered suitable for distance learners as it is more effective because learning activities can take place anywhere and anytime (Nindhita, 2022). E-learning developed at UT is a learning management system (LMS) that connects teachers and students. In e-learning there are tutorial assignments to measure student abilities. However, to support the needs of students to achieve 21st century competencies, tutorial assignments must be designed in such a way as to suit the challenges of the era, namely with questions that match higher order thinking skills (HOTS).

The questions on tutorial assignments on e-learning should also raise students' critical thinking and creative thinking skills. However, whether the current tutorial assignments have led to higher order thinking skills (HOTS) or are they still at the level of low thinking skills which is characterized by asking for an explanation of a concept. Hence, this study aims to " analyze tutorial assignments in UT e-learning to improve 21st century competencies in Educational Technology students." Therefore, this study will explore the analysis of tutorial assignments on e-learning to evaluate the 21st century competencies of UT Educational Technology students. This research

contributes to giving evaluation and recommendations on how e-learning tutorial assignments are supposed to be written. Hence, it is hoped that students could also enhance their competencies based on their level.

METHODS

The research design in this study is a mixed method consisting of qualitative and quantitative research. Qualitative research was carried out in the form of document study of tutorial assignment documents along with student answers. For quantitative research, a questionnaire was conducted on student perceptions of 21st century competencies.

The subjects of this research are students of the Educational Technology Education Study Program at the Open University who follow online tutorials with LMS at https://elarning.ut.ac.id. The research sample is 28 students who take the Utilization of Learning Sources course. Educational Technology students were chosen because they are related to the Education technology area, where graduates' learning outcomes are for design, utilization, management, evaluation and development. This Educational Technology Area prepares students to be able to do the five areas that are closely related to higher order thinking skills based on Bloom's revised taxonomy (applying, evaluating and creating).

This study focuses on examining tutorial assignments and also secondary data in the form of student's submission on tutorial assignment. The number of tutorial assignments studied were assignments at meetings 3, 5, and 7, and the number of samples studied was 1 tutor class.

The method used in this research is qualitative and quantitative research. Qualitative research is used to see the use of LMS in the form of tutorial assignments as well as responses from students in answering these assignments. In this case what is needed is secondary data from the LMS. These results are then analyzed using the 21st century competency rubric (critical thinking and problem solving) to find out how tutorial assignments help improve 21st century competencies. The quality assessment of these features already been reviewed by correctors or experts in learning design and program evaluation.

In addition to qualitative data, quantitative research was also carried out. Quantitative research was conducted to determine student perceptions of 21st century competencies. Quantitative research will be given in the form of questionnaires asking about students experience in following online tutorial lectures. Quantitative research examined students' perception of using e-learning to improve critical thinking skills and problem-solving. The survey will be conducted with 18 items from 5 Likert scale. The Likert scale is a statement that will be answered from 1 (strongly disagree) to 5 (strongly agree). After the data has been analyzed qualitatively and quantitatively, recommendations will be made on taking advantage of features in the LMS to improve 21st century capabilities.

RESULTS AND DISCUSSION

The results based on study analysis were made from secondary data of LMS Universitas Terbuka that was accessed using http://elearningbackup.ut.ac.id in subject TPEN4208 *Utilization of Learning Resources* in 2022.1 semester. Types of analysis used in these documents is content analysis, which means to collect and analyze the selected documents (Sugiyono, 2020). The findings consist of qualitative analysis of tutorial assignments 1, 2, and 3 that were matched and analyzed according to the cognitive domain by Krathwohl (2002). Cognitive domain according to Anderson & Krathwohl (2001) and Krathwohl (2002) encompasses (C1) Remember, (C2) Understand, (C3)

Apply, (C4) Analyze, (C5) Evaluate and (C6) Create. The thinking process is divided into Higher Order Thinking Skills (HOTS) and Lower Order Thinking Skills (LOTS). Low-level thinking skills involve the ability to remember (C1), understand (C2), and apply (C3), while high-level thinking skills involve analysis and synthesis (C4), evaluating (C5), and creating or creativity (C6). Analyzing this revised Bloom's taxonomy also includes the ability to organize and connect between parts so that a more comprehensive meaning is obtained. When the ability to analyze leads to a critical thinking process so that a person can make the right decisions, that person has reached the level of evaluating thinking. From evaluation activities, one is able to find strengths and weaknesses. Based on these strengths and weaknesses, new ideas are finally generated or differentiated from existing ones. When a person is able to generate new or different ideas or ideas, that is the level of thinking called the level of creative thinking (Setiawati et al., 2019). Accordingly, the document was also analyzed by the revised Bloom's operational verbs. The picture below is the structure of the Cognitive Process Dimension.

Structure of the Cognitive Process Dimension of the Revised Taxonomy

1.0 Remember – Retrieving relevant knowledge from long-term memory.
- ***1.1 Recognizing***
- ***1.2 Recalling***

2.0 Understand – Determining the meaning of instructional messages, including oral, written, and graphic communication.
- ***2.1 Interpreting***
- ***2.2 Exemplifying***
- ***2.3 Classifying***
- ***2.4 Summarizing***
- ***2.5 Inferring***
- ***2.6 Comparing***
- ***2.7 Explaining***

3.0 Apply – Carrying out or using a procedure in a given situation.
- ***3.1 Executing***
- ***3.2 Implementing***

4.0 Analyze – Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose.
- ***4.1 Differentiating***
- ***4.2 Organizing***
- ***4.3 Attributing***

5.0 Evaluate – Making judgments based on criteria and standards.
- ***5.1 Checking***
- ***5.2 Critiquing***

6.0 Create – Putting elements together to form a novel, coherent whole or make an original product.
- ***6.1 Generating***
- ***6.2 Planning***
- ***6.3 Producing***

Figure 1. Cognitive Domain taken from Krathwohl (2002)

The result of this study indicates lower order thinking skills were still present while higher order thinking skills questions were absent. It can be noted in the following table of LOTS and HOTS Questions on Tutorial Assignment.

Table 1. LOTS and HOTS Questions on Tutorial Assignment

Tutorial Assignment	Keywords (Operational verbs)	C1	C2	C3	C4	C5	C6
Tutorial Assignment 1	Compare Explain	0	2	0	0	0	0
Tutorial Assignment 2	Compare Give examples	0	2	0	0	0	0
Tutorial Assignment 3	Explain Compare	0	2	0	0	0	0

From Table 1, we can infer that based on the cognitive domain, the questions on tutorial assignments were still in C2 Understand. From the document, the assignments only asked for finding the difference and explaining. These lower-level questions cannot access how students analyze, which according to Utari (2011) is the ability to separate concepts and connect with one another in order to gain an understanding of a concept. Hayikaleng et al. (2016) argue Lower order Thinking Skills (LOTS) questions are not recommended for teachers to ask. Referring to Setiawati et al. (2019), questions that express Higher Order Thinking skills have characteristics such as transferring one concept to another; processing and applying information; synthesizing from different information; evaluating and applying that information to solve a problem; and critically reviewing ideas and information. Teachers or lecturers are directed to develop guide questions and activities to move from LOTS questions to HOTS questions to activate schema in students and increase understanding beyond the available reading.

The following is a qualitative analysis of students' submissions on Tutorial Assignment Questions. From the population of 28 students, 15 students were sampled with a random sampling method. Each tutorial assignment consists of two questions. Thus, students' answers were analyzed according to two indicators of 21st century skills: Critical Thinking and Problem-Solving skills. Another research conducted by Pellegrino & Hilton (2013) divides various 21st century competencies into three different domains, cognitive competence, intrapersonal competence and interpersonal competence. Cognitive competence comprises critical thinking, problem-solving, decision-making, creativity and innovation, and information literacy. Hence, in this study, the two main common competencies were exposed: critical thinking and problem-solving. Table 2 shows an analysis of students' answers on tutorial assignments regarding their critical thinking and problem-solving skills. Stages on the table are adapted from Setiawati et al. (2019) indicating the level of their thinking skills and how they can comprehend, analyze, and elaborate their answers. Stage 1 represents the lowest answer level by only comprehending and answering without elaboration. Stage 2 shows a low level of elaboration and analysis shown by minimal paraphrasing of their answer. Ideally, students use their thinking skills to synthesize the information, evaluate the remaining information and compile it using their understanding. Stage 3 indicates the highest level in answering questions. Students point out reasoning and deep learning characterized by applying the concept in different situations. These stages can show students' thinking skills and how deeply they can convey ideas, analyze and synthesize into an elaborative answer.

Table 2. Students' submissions on Tutorial Assignment

Tutorial Assignment	Tutorial Assignment 1		Tutorial Assignment 2		Tutorial Assignment 3	
21st century competencies	Critical Thinking	Problem Solving	Critical Thinking	Problem Solving	Critical Thinking	Problem Solving
Student 1	Stage 2	Stage 2	Stage 1	Stage 2	Stage 2	Stage 1

Student 2	Stage 2	Stage 1	Stage 1	Stage 2	Stage 1	Stage 1
Student 3	Stage 2	Stage 2	Stage 1	Stage 1	Stage 2	Stage 2
Student 4	Stage 2	Stage 1	Stage 2	Stage 2	Stage 2	Stage 2
Student 5	Stage 3	Stage 3	Stage 1	Stage 2	Stage 3	Stage 3
Student 6	Stage 1	Stage 1	Stage 2	Stage 2	Stage 1	Stage 1
Student 7	Stage 2	Stage 3	Stage 1	Stage 1	Stage 2	Stage 2
Student 8	Stage 2	Stage 2	Stage 2	Stage 3	Stage 2	Stage 3
Student 9	Stage 2	Stage 2	Stage 2	Stage 2	Stage 2	Stage 1
Student 10	Stage 2	Stage 2	Stage 2	Stage 2	Stage 1	Stage 1
Student 11	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 1
Student 12	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 1
Student 13	Stage 2	Stage 2	Stage 1	Stage 2	Stage 1	Stage 1
Student 14	Stage 2	Stage 2	Stage 3	Stage 2	Stage 1	Stage 2
Student 15	Stage 1	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1

Based on Table 2, we can interpret that most students were still in stages 1 and 2. Stage 3 should be the highest, while their answers according to 21st century competencies were mostly reported in stages 1 and 2, meaning they still need to practice their thinking skills. A student should actively learn when he analyzes, evaluates, and creates. When a student receives information, then he is just a passive learner. There are two advantages of using HOTS in the classroom, firstly HOTS will increase academic achievement and produce lifelong learners. The same opinion is expressed by Lewis & Smith (1993) that higher order thinking skills will emerge when a person receives new information, and the information is stored in memory and interrelated to achieve a goal or find possible answers to difficult situations. This includes deciding to believe, deciding what to do, creating new ideas or predicting and solving routine problems. Table 1 shows that the tutorial assignments only reach C2 level, then they only cover for Lower order thinking skills. This result correlates with students' submission on tutorial assignments. Tutorial assignments have not yet encouraged students' thinking skills, especially critical thinking, and problem-solving skills. In order to encourage students to think deeply, analyze, make a judgment or even create, students need to be stimulated by HOTS questions. HOTS, as a transfer process in the learning context, aims to create meaningful learning, which focuses on the ability of students to apply what they have learned to new situations without the direction or guidance of lecturers or other people. Moreover, HOTS is also seen as a critical thinking process to form students who can think logically (reasonably), be reflective, and make decisions independently. In addition, HOTS as a problem-solving process will enable students to solve real real-life problems, generally specific ones, so the solving procedure is also unique and is not routine (Setiawati et al., 2019). However, according to the result from table 1, this proves that lower level of assignments will also affect students' thinking skills. Students have not yet refined their critical thinking and problem-solving skills.

Aside from qualitative analysis, quantitative analysis was also processed in this research. Quantitative analysis was derived from questionnaires admitted to some students to find out their perception towards the Learning Management system (LMS) and how the tutorial assignments can help them sharpen their thinking skills. The questionnaire was a 5-scale Likert that encompasses 18 questions that have favorable and unfavorable statements. The data was then analyzed, and the result of the questionnaire is shown in the following chart:

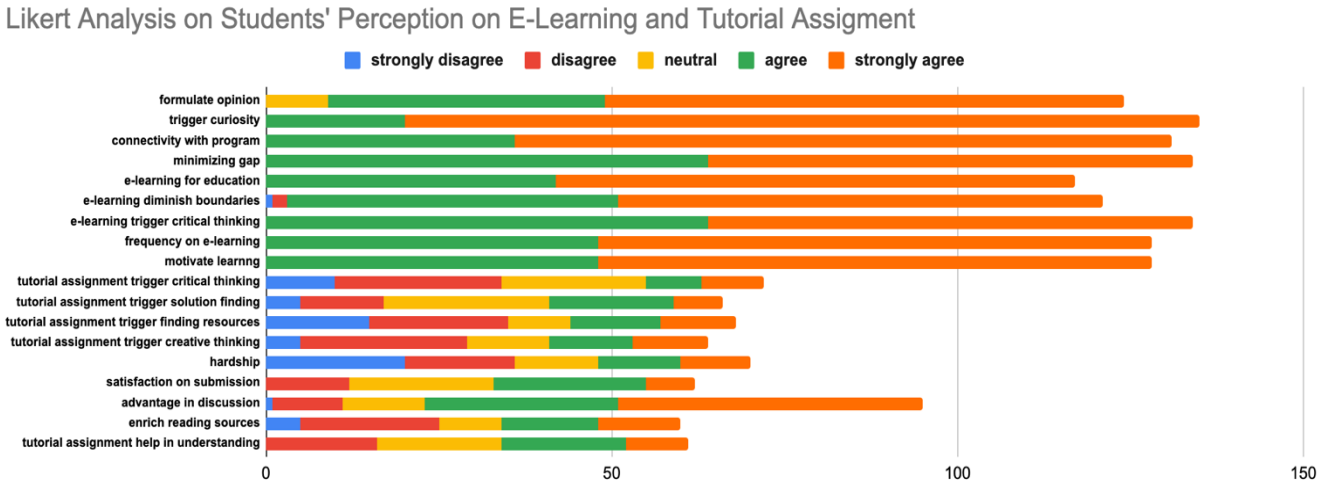

Figure 2. Quantitative analysis on students' perception.

According to the chart above, it is known that on the notion of LMS and its features, most students strongly agree that e-learning supports their study. LMS provides a virtual platform for online learning, to monitor students, deliver, test, and communicate with students (Cavus, 2015). Also, LMS provides a platform for students' virtual learning environment and is developed with a social-constructivism approach. It is known from figure 1 that students agree with the notion that e-learning motivates learning, triggers curiosity and stimulates critical thinking. The discussion forum on LMS emphasized that e-learning must provide facilities for group discussions with professional assistance in their field. This result is in line with the statement from Cavus (2015) that by joining discussion forums and having assignments, students can see direct feedback so they will know their achievements. As a distance learner, LMS has become one of many ways that could connect UT students with their courses. Students can better assess their learning progress as they learn to use LMS features, and thus, they will begin self-regulating their progress (Bradley, 2021). Hence, the use of LMS is essential in supporting the learning activity.

In contrast, when it comes to how tutorial assignments can support their thinking skills, the results were low or many of them find it unsupportive. These results relate to the previous tables where higher order thinking skills were not present in the tutorial assignments questions, affecting students' answers/submissions and also lack critical thinking and problem-solving. This aligns with the statement from Conklin (2012) that argues critical thinking is also associated with higher order thinking skills. Moreover, critical thinking is about one making careful analysis and judgment. For that reason, it is important for educators to be able to develop HOTS questions to enhance students' thinking skills.

In terms of giving assignments, it is important for students to possess a good understanding of non-testing assessments and be assured that learning resources (books and chapters) are all accessible and the lecturer also shows how giving examples and giving students a chance to try them and consult the results (Mugiarso et al., 2019). Educators or lecturers must improve their capability to develop a well-designed assignment that sharpens students' 21st century competencies. Several amounts of research recommend applying project-based learning as an instructional strategy that has proven to be effective in helping students enhance their 21st century skills (Balemen & Keskin, 2018; Basilotta Gómez-Pablos et al., 2017; Husin et al., 2016; Putri et al., 2019; Rabacal et al., 2018). This instructional strategy could help students by learning how to solve real-world problems based on authentic projects and to have ownership of their own projects and learning process.

CONCLUSION

Based on the data analysis and the findings, there are significant gaps between expected outcomes and actual outcomes. Turns out that online tutorial assignments in "Utilization of Learning Sources" course have not yet led to higher order thinking skills and have not yet supported 21st century competencies. The study results indicate that tutorial assignments need to be evaluated for their content and context, as they were still asking lower order thinking skills (LOTS) like finding differences and explaining instead of higher order thinking skills (HOTS) questions. Accordingly, that lower level of assignments will also affect students' thinking skills. Students have not yet refined their critical thinking and problem-solving skills. Therefore, generating HOTS questions is a challenging task. However, there are many references in developing HOTS questions. Generating HOTS Questions could also be in the form of projects. Students can explore and analyze a case to find a solution to the problem. Those tutorial assignments are supposed to assess their C4, C5, and C6 domain, and to make that happen, tutors or lecturers should also be equipped and trained. Students, in this case, also need to prepare and put all effort into growing and become equipped with 21st century competencies. Thus, it is recommended that the learning experience become ownership for the students so that they could be more attached and eager to learn in doing the assignments. Making contextual project-based assignments and embedding learning with 21st century skills will enhance students' competencies. This study could lead to further research in developing higher order thinking questions for students' assignments.

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