

An Analysis of Student's Critical Thinking to Improve the Higher-Order Thinking Skill of Undergraduate Pharmacy Students

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ABSTRACT

The learning process in the 21st century must be contextual and require the Higher-Order Thinking Skill (HOTS) to prepare students in their life situations. The aim of this research is to analyze the students' critical thinking skill in improving HOTS of undergraduate pharmacy students. This student's essential thinking skill including HOTS, knowledge of theoretical concepts, and skill of students in the learning process. This research was conducted towards the first-year students of pharmacy undergraduate with three major subjects, including cell biology, basic chemistry, and basic pharmaceuticals. The qualitative descriptive method with assessment, observation, and interview in collecting data was used in this research. The population sample made up of thirty-eight students. The categories of students' critical thinking are divided into a low, moderate, and high percentages. The study shows that higher-order thinking skill of students was improved when a learning process pushed in activating the student's critical thinking.

Keywords: higher-order thinking skill, learning process, student's critical thinking

1. INTRODUCTION

The development of technology has a significant influence on the educational process, which also has an impact on changing the role of teachers. The result of science and technology in the 21st century has changed the characteristics of students. Therefore, it requires orientation and innovative ways of learning. Based on the learning objectives, it has new orientations due to the development of science. Also, judging from the characteristic aspect of the field of study is influenced by discoveries (Caena & Redecker, 2019; Spector et al., 2016). These changes have the consequence of adjusting the role of the teacher. 21st-century learning orientations in the form of various 21st-century skills that are important for students to master, such as critical thinking and problem solving, creativity and innovation, cross-cultural understanding, communication, information and media literacy. Also, it included computing and ICT literacy, life and career skills. The types of skills needed are contained in 4C (Creativity, Collaboration, Critical Thinking, and Communication) (Darling-Hammond, Hyler, & Gardner, 2017; Luna Scott, 2015; Spector et al., 2016).

Every university or higher education prepared its students as best as they can, including Information technology (ICT), critical thinking, problem-solving, creative thinking, and cooperation. In pharmacies curricula, universities or higher education required the

student to critically thinking in solving the patient's complex problems, analyze and produce pharmacy's toll for practice, and solve the environmental issues based on pharmacist skills (Brewer, Kramer, & O'Brien, 2009; Education, 2015; Maudsley & Strivens, 2000). Information technology (ICT) is one of the vital knowledge as best as excellent communication skills. Therefore, 21st century learning required those competencies in a learning process (Geisinger, 2016; Retnawati, Djidu, Kartianom, & Anazifa, 2018; Van Laar, Van Deursen, Van Dijk, & De Haan, 2017). To encourage those skills, instructional methods in theory and practice should be done in a learning process. The various teaching approaches, strategies, and models used by educators must be developed while critical thinking in theory and practice is included (Martin, Donohoe, & Holdford, 2016; Persky, Medina, & Castleberry, 2019). Those various teaching approaches, methods, and models were supported by information technology, an e-learning system, and a new pedagogic or curriculum to enhance education quality in this era.

The higher cognitive skills, knowledge of theoretical concepts, and attitudes of students in learning including creativity, collaboration, critical thinking, and communication become a part of critical thinking in higher education in either theory or practicum (Gube & Lajoie, 2020; Meyer & Wood, 2017). The options of critical thinking included but were not limited to analysis, inference, evaluation, explanation,

interpretation, and inquisitiveness (CARVALHO et al., 2015; O'Halloran, Tan, & E, 2017; Stephenson, Miller, & Sadler-McKnight, 2019). This required the planning of the pedagogic approaches. The competence of knowledge and skill must relate not only in theory but also in experimental learning. Therefore, students highly needed the ability to transfer the process in the classroom learning situation to real-life situations.

In the 21st century era of learning, higher-order thinking skill (HOTS) approaches were required in a learning process. In HOTS approaches, analyzing, evaluating, and creating a solution to the problems included in student's ability (Garcia, 2015; Ichsan, Sigit, Miarsyah, Ali, & Suwandi, 2020; Saido, Siraj, Dewitt, & Al-Amedy, 2018). By knowing the high-level thinking skill of students, educators have the consideration in the delivery of their learning process. The students who have this skill will be able to connect, manipulating, and transforming their knowledge and experiences to adapt to the 21st century situation and competition. Hence, students can achieve the transferable skill of theory in the classroom learning situation in a real-life case. Assessment of HOTS included logical reasoning, judgment and critical thinking, problem-solving, creativity and creative thinking (Apino & Retnawati, 2017; Pratama & Retnawati, 2018; Tambunan, 2019).

Our previous research shows the positive correlation in using critical thinking skills for improving practice skills in the context of laboratory research of course research experiences, particularly in pharmacy students (Haritani, Febriani, Puspita, & Arviana, 2019). Therefore, in this continuing research, we assume that critical thinking also can improve the student's HOTS in the classroom of undergraduate pharmacy students. It was also supported by the capability of students in utilizing information technology (ICT) as excellent communication skills. Based on the previous research, the study shows that students of Universitas Hamzanwadi used the high frequency and intensity of internet. Therefore, in improving an e-learning system, this data becomes primary data (Doni Septu Marsa & Yuyun, 2018). These research results will support the critical thinking of students in improving their HOTS in a learning process.

This research focused on analyzing the critical thinking of students to improve their HOTS. Three subjects in the first semester of the first-year students of pharmacy's department used in this research, including cell biology, basic chemistry, and primary pharmaceutical. Those subjects are considered fundamental knowledge for pharmacy students. There was variety of researches on an undergraduate student in improving the critical thinking skill included model,

method, and measurement of necessary thinking skills. But none of our best knowledge focused on analyzing the student's critical thinking to HOTS of undergraduate students of pharmacy.

Furthermore, this research was supported by the previous study in critical thinking in the context of course research experiences. The objective of this research was to analyze the crucial review of the undergraduate students of pharmacy in improving their HOTS, mainly in theory courses. Furthermore, this study was aimed to answer the following questions: 1) How the descriptive explanation of assessment, observation, and interview resultsd in students' critical thinking skill 2) How the students' essential thinking skill improves the HOTS of students.

2. METHOD

Design

The qualitative descriptive with an inductive approach design was used in this study (Kemparaj & Chavan, 2013; Liu, 2016). Furthermore, assessment, observation, and interview were used for collecting data (Fathy & Morsy, n.d.; Nassaji, 2015).

Participants

The first year of undergraduate students of the pharmacy department of Universitas Hamzanwadi, East Lombok participated in this study. They programmed three subjects, including cell biology, introductory chemistry, and primary pharmaceutical during the first semester. Around 38 students participated in this research, divided into 32 female and 6 male with the interval age of 18-19 years old.

Data Collection

In this research, assessments, observation, and interview of three courses in the first semester were used to collect the data, including cell biology, basic chemistry, and introductory pharmaceutical. This data will analyze the critical thinking of students to improve the student's HOTS.

Data Analysis

Assessments and observation data of this study were analyzed by qualitative description and range category based on a percentage of the total sample (n=38). At the same time, student's interview data were also analyzed by qualitative description and range category. The range category in this research is divided into three level categories, namely low, moderate, and high category (Brannen, 2017).

3. RESULTS AND DISCUSSION

The Qualitative Description of Student's Critical Thinking

For the first-year students of the pharmacy department, they programmed seven courses, including

cell biology, introductory chemistry, and basic pharmaceutical—those subjects considered as basic knowledge and concepts in pharmacy curricula. Hence, the students' critical thinking for those subjects is highly essential to analyze. Also, the analysis results will correlate with improving the students' HOTS, particularly in the pharmacy department.

In this research, the qualitative description describes a range category. The range category is divided into three categories, including the low, moderate, and high category. This range based on the critical thinking aspects included analysis, inference, evaluation, explanation, interpretation, and curiosity.

a. Cell Biology

Low Category: The students were identified as not being able to completely and correctly describe the tasks and functions of cell organelles and the interaction processes that occur between cell organelles. They were only able to tell part of the tasks and functions of cell organelles correctly. They have less ability in analyzing and understanding the topic. Therefore, the lack of evaluation, interpretation, and curiosity of the topic affect students' conclusion and reports.

Moderate Category: The identified students showed the ability to describe the tasks and functions of cell organelles correctly, but they have not been able to correctly describe the process of interactions that occur between cell organelles. Students' answers were still classified as merely based on textbooks since they had not been able to develop creative responses. They have the ability in analyzing and understanding the topic. They are still quite enough in evaluation, interpretation, and curiosity of the subject.

High Category: The students had been able to describe the tasks and functions of cell organelles accurately. They also had been able to describe interactions between cell organelles creatively and interactions between cell organelles and analogize them with daily activities. They also can explain the interaction between cell organelles using images. They have a comprehensive ability in analyzing and understanding the topic. They have the power in evaluation and interpretation of the data, and inquisitiveness.

b. Basic Chemistry

Low Category: The students were identified as not being able to completely and correctly describe the atomic structural concepts of the quantum mechanical theory. They were only able to explain the part of the nuclear structure and the location of neutron, proton, and electron in the atomic structure. They have less ability in analyzing and understanding the topic, particularly in electron configuration based on the quantum mechanical theory. Therefore, the lack of

evaluation, interpretation, and curiosity of the topic affect students' conclusion and reports.

Moderate Category: The identified students showed the ability to describe the atomic structural concepts of quantum mechanical theory correctly, but they have not been able to arrange the electron configuration with the quantum mechanical theory. Students only understand the example questions, and they had not been able to develop their answers in other problems. They have the ability in analyzing and understanding the topic. They are still quite enough in evaluation, interpretation, and inquisitiveness of the matter.

High Category: The students had been able to describe the atomic structural concepts of a quantum mechanical theory accurately. They also had been able to arrange the electron configuration with the quantum mechanical theory. They also can explain and the topic to other students. They have a comprehensive ability in analyzing and understanding the subject. They have the power in evaluation and interpretation of the data, and inquisitiveness.

c. Basic Pharmaceutical

Low Category: The students were identified as not being able to completely and correctly describe the various dosage forms, including concrete, liquid and semi-solid. This condition will affect the readiness of these students to understand other pharmaceutical science. In this category, they have less ability in analyzing and understanding the topic. Therefore, the lack of evaluation, interpretation, and curiosity of the topic affect students' conclusion and reports.

Moderate Category: The students were identified as being able to describe and divided the solid and liquid dosage forms correctly, but in categorizing the semi-solid dosage forms students still cannot tell them accurately. Likewise, the description of the various forms of medicinal preparations, students always find it hard to categorize, and they were too fixated on memorizing. In this category, they have the ability in analyzing and understanding the topic but still quiet enough in the evaluation, interpretation, and inquisitiveness of the issue.

High Category: The students were identified as being able to describe solid, semi-solid and liquid dosage forms and were able to categorize various kinds of drugs that were included in the three dosage forms. They also can explain creatively and correctly in front of other students. In this category, they have a comprehensive ability in analyzing and understanding the topic. They have the power in evaluation and interpretation of the data, and inquisitiveness.

Number of Student's Critical Thinking

The number of student's critical thinking in this research was 38 students in the first-year students of the

pharmacy department. It was analyzed by descriptive analysis with percentage. Then, the number of student's critical thinking show in the following table:

Table 1: Number of Student's Critical Thinking

First Semester Course-Undergraduate	Category Percentage (n=18)		
	Low n (%)	Middle n (%)	High n (%)
Cell Biology	14 (36.84%)	15 (39.47%)	9 (23.68%)
Basic Chemistry	17 (44.73%)	15 (27.78%)	15 (27.78%)
Basic Pharmaceutical	12 (31.57%)	15 (39.47%)	11 (28.94%)

The Higher-Order Thinking Skill of Pharmacy Students

This research used the higher-order thinking skill approach in arranging the problem of the topic in the three courses in the first semester of the first-year undergraduate students. For assessment of HOTS in this study focus on logical reasoning, judgment and critical thinking, problem-solving, creativity and creative

thinking. We also emphasized collaboration and communication in solving the problems. The student's HOTS is also categorized by range category (low, moderate, and high) and analyzed by descriptive analysis with percentage. The following table of the number of student's HOTS will describe below:

Table 2: Number of Student's HOTS

First Semester Course-Undergraduate	Category Percentage (n=18)		
	Low n (%)	Middle n (%)	High n (%)
Cell Biology	13 (34.21 %)	15 (39.47 %)	10 (26.31 %)
Basic Chemistry	15 (39.47 %)	16 (42.10 %)	7 (18.42 %)
Basic Pharmaceutical	12 (31.57%)	16 (42.10 %)	10 (26.31 %)

In the qualitative description, students were categorized in the low category if they lack in analysis and inference. Hence for the moderate and high category, students have the ability in evaluation, explanation, interpretation, and curiosity. Also, for the high category, the students show their knowledge in collaborating and communicating in groups working. They got all of those aspects in the first semester of the first year as students in the pharmacy department. The students still have difficulties in developing their concepts to solve the other problem and transfer those skills in their life situations. In the learning process, life situations show in group working and discussion sessions. Therefore, to transfer the skills to real-life situations as the primary purpose of a learning process can be achieved (Hauhart & Grahe, 2015).

Those results are strengthened by the number of category percentages of students' critical thinking and HOTS above. The rate of those numbers above has the similarity both in number and the students, personally. Moreover, some of the students in the low category in the cell biology course were the same students in introductory chemistry and basic pharmaceutical class. Neither it is for the moderate and high category, respectively. Hence, there were three points shown in

this study: 1) the emphasize of students critical thinking in improving students HOTS from the first semester in the first year of undergraduate must be done, indeed; 2) The emphasize in the introductory course in each department should be classified soon; 3) The emphasize on collaboration and communication of students in their working and discussion group must be considered in the learning process using HOTS approach.

Therefore, based on that data, critical thinking has the relationship with student's HOTS. To improve the student's HOTS, the teacher must push the learning process, which activates the students' critical thinking. Hence, counseling action in the learning process must be done and giving extra attention and developing the comprehensive knowledge of the students should push continuously. But to improve and increase the complete understanding is not an easy matter and able to be achieved in a short time (Schmoker, 2018). They need more effort and continuous improvement to get the achievement in the learning process.

4. CONCLUSIONS

The descriptive analysis of assessment, observation, and interviews in analyzing the critical thinking skill shows a positive relationship. To improve the higher-

order thinking skills of students, educators should push the learning improvement in activating the student's critical thinking.

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