



Correlation of Epistemic Curiosity and Cognitive Understanding Biology's Student in Health and Pharmaceutical Biotechnology

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Abstract

Technology growing rapidly because technological development is required in all aspects of human life. Biotechnology is one of the branch of biology that is constantly evolving. Health and pharmaceutical biotechnology is one of the biotechnology which became the spotlight of the world. Biotechnology is part of science that commences from curiosity. One of curiosity type is epistemic curiosity (EC). Epistemic curiosity contribute to give problem solving for the appearing issue. This need higher order thinking. Higher order thinking need good cognitive understanding. The purpose of this study is to: 1) describe the epistemic curiosity (EC) Biology' student to the development of health and pharmaceutical biotechnology, 2) analyzing the correlation of epistemic curiosity (EC) and cognitive ability of biology' student in health and pharmaceutical biotechnology. This research includes descriptive correlative with the research data is a cognitive understanding and EC of biology' student. Cognitive understanding and EC data taken using a questionnaire (i-d scale curiosity) and problem (the quiz). Average of EC scores is 26,1. A descriptive analysis of the average EC is of 65.3% (high category). The average of student's cognitive understanding is 38.8%. (low category). Quantitative correlation of cognitive understanding and EC was 0,208 (weak category). Qualitative correlation of cognitive understanding and EC was J category, that have a high EC but low cognitive understanding.

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INTRODUCTION

Health and pharmaceutical biotechnology is one of the biotechnology that becomes the spotlight of the world, including Indonesia. The Ministry of research and technology of the Republic of Indonesia (2006) even suggested that future challenges to health problems in Indonesia is a double burden of disease that are described with still high communicable diseases and the increasing metabolic syndrome and degenerative. The difference in health status based on the socio-economic level would still be a problem until the year 2025, along with the mobilization of the population (people's movement). Strengthening of health science and technology needed to support the improvement of health services and enhance the capabilities and self-reliance health technology.

Development of science commenced from curiosity, which is a characteristic of human beings. Human beings have curiosity about things, the surrounding nature, outer space, even about her/hisself. A man with a great curiosity, always trying to find a description of the observed natural phenomenon. So, it think out to natural sciences (Sutarman et al. 2016:13). Further, according to the higher education research & technology (2016), suggested that improved quality of higher education is the first priority of the strategic plan of higher education 2015-2019. This can be started from a curiosity on students. Curiosity is part of the scientific attitude which must-have. Arnone et al. (2011) found that curiosity become the strongest motivator in behaviour, as a base to launch direct action environmental investigation on someone to resolve uncertainty and create new knowledge.

Human curiosity can not be satisfied by observations or experiences only to satisfy the natural mind (Sutarman et al. 2016:14). Curiosity is required in science or information. Curiosity started by interest or anxiously to something. Anxious can be a question about something that observed (involving human senses). An interest will be continued with search information through reading. The results of the readings will be recorded in the memory. It make humans be more insightful about the objects that sought.

College vision and mission have made graduates competent and in accordance with their fields. Pratama (2016) mentions that the Unnes vision is to become the University of reputable international conservation and insightful. One of the goals is produce graduates who have excelled in the field of competence of the knowledge, technology, art, and sports an insightful conservation.

Gradute competence that means is not only hardskill, but complete with softskill. This skill use as provision to be success later. There are seven survival skill that importance on the 21th century. That skill are cover: (1) critical thinking and problem solving; (2) collaboration pass network and lead by influence; (3) adapted; (4) initiative and entrepreneurship; (5) effective communicate both written and unwritten; (6) access and analyze information; (7) imagination. That direct into curiosity of scientific attitude (Wisudawati 2013). National education civilize student's curiosity, study culture, and high appreciate in science achievement(Kemenristek 2013:19). However it is not yet known if this also happens on the level of the college student. Curiosity has not been much scrutinized, especially epistemic curiosity (EC).

Berlyne (1954) defined as the activity to know EC evoked by the concept of the puzzle and the gap. The EC has not been much researched in Indonesia. Litman and Spielberger (2003) have been researching how to measure components of EC. This activity includes asking or solve the problem which is the enrichment and development of the intellectual.

Previous research done by Litman (2008). Litman has compiled the top ten things that can be used to measure the EC. Ten of these are composed of five items of interest (i-type) and five item of deprivation (d-type). Ten items of EC has been used to study the relationship of the EC with the learning-achievement goals. Litman suggested that further research can be done studies that connect between i-d type EC learning goals, and learning outcomes. These suggestions become the main

runway to do research that is about the consequences of the EC against the learning outcomes dideterminasi through cognitive understanding. So far, there has been no research that describes EC and be correlated with the learning outcomes (cognitive) students on the material of biotechnology health and medicine.

RESEARCH METHOD

This research was conducted in Biology Department, Mathematic and Science Faculty, Semarang State University in May 2017 until February 2018. The respondend of this study is the 2013 – 2015’s Students of Biology department. Descriptive research correlative with research conducted curiosity (EC) and understanding cognitive students of biology. Research conducted curiosity (EC) and understanding cognitive students was taken by questionnaire (i-d scale epistemic curiosity) and Test (Quizzes). Interviews were conducted to several respondents if necessary. The scor of EC and understanding cognitive descriptive analyzed by using microsoft excel 2010 and the Analysis of the Correlation was done by SPSS 20 program.

RESULTS AND DISCUSSION

Epistemic curocity (EC) is one of the forms of behaviour. Things that can add the EC significantly is incongruity, suprisingness, relative entropy, and absolute ebtropy (Berlyne 1957). The Data of curiosity all students analyzed at the same time although respondents different (force levels). Processing data was undertaken based on the research done Arnone et al.(1994) stated that there are no significant differences curiosity of the respondents each force program . Arnone do research the influence of curiosity to learn from the supervision college students 1 and 2.

Table 1 Data EC’s biology stutudent in health and pharmaceutical biotechnology

Data	Result
Lower score	15
Higher score	38
Average score	26,1
Average % of EC	65,3
Criteria of EC	high

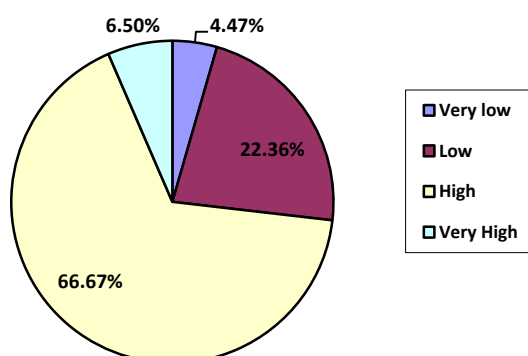


Figure 1 Amount of Biology’s students in every EC criteria about health and pharnaceutical biotechnology

Epistemic curiosity (EC) is an event to know that were brought about by the concept of riddles and the gap knowledge (Berlyne 1954). Table 1 shows that the results of the ec students having the average score 26.1. A description of the EC analysis of biology students reached 65,3%, is in the category of high. Picture 1 shows there are the four categories of EC are students of biology to the development of health and pharmaceutical biotechnology. Four categories are students that have a score of EC very low, low, high, and very high. As many as 11 students (4,47 %) have a score of EC very low and 55 students (22,36 %) have of inferior scoring .this is caused by student's interest. Which has a score students EC low or very low felt that they were not interested in the field of health and pharmaceutical biotechnology. A students who has a score low or very low having interest in other fields. Other fields who follow baccalaureate degrees are going to ecology, the tissues culture of plants, photography, arts, and others. Besides interest, students consider that the matter of biotechnology constitutes difficult and abstractly materials. Students are studying biotechnology especially in the health sector and pharmaceutical just for fulfill their need in the college.

As many as 64 students (66,67 %) have a high EC score and 16 students (6.5 %) have a very high EC score. Indirectly, it shows that respondents interested in studies biotechnology in the field of health and pharmaceutical. These respondents are unaware of the importance of biotechnology in the field of health and pharmaceutical. Anwar (2010) support this reason that the role of science and technology are more and more large. So that biotechnology is important. Based on interviews, respondents feel benefits and obtain information important about biotechnology in the field of health and pharmaceutical. The respondents will be keep looking through some media like the internet, and books as a source of reference. The respondent will be stopped if a respondents had been satisfied and get the right answer.

The average of students receive a high score at the EC level. A person who has high EC realized that the field of health and pharmaceutical biotechnology is the important thing to the social life and as a source of literacy. To get interest things to looking for is about problems in the community, especially that appears in the family. One of the topics needed is cases of diabetes which are handled with insulin. The results of research support Fonseca et al. (2013) stated that, the introduction of the scope and the depth of biotechnology, especially about the understanding of the community on the application of biotechnology has been developed by adding the scope of curricular biotechnology topic, the development of a number and source of as literacy. Students who have high EC think that biotechnology the field of health and pharmaceutical important. Which is becomes the reason is biotechnology give a big chance work in the future. Steele & Aubusson (2004) affirming that in the job sector, loaded in with a chance of professional job of biotechnology, so as to be something that matters in the progression of rendering and capable of maintaining economic a country.

The result of a high EC showing a high interest of students in developing biotechnology of health and pharmaceutical major. The results of this research less supportive with Aritonang (2008) that the interest and the motivation to study has huge of the results of the study. The average of cognitive understanding score shows low results. It means, the curiosity do not give a big contributing for cognitive understanding.

Students who have high EC will learn something new of health and pharmaceutical biotechnology to find out more (i-d scale number 5). The reasons why someone find out about a knowledge than others are (1) psychoanalysis (desire to know the component of something); (2) gestalt psychology (the gap); and (3) strengthening theory (Berlyne 1954). One of the things to find out more is reading.this is consistent with Anugra et al. (2013), that curiosity is one of the factors that affect the reading interest of students.

Curiosity (EC) can not be separated from looking for more information relevant to come up with a solution. A student who have a high score of EC tending to seek for more information than just to waiting for an explanation from a lecturer in the class. These results support Puspitasari et al.

(2015) that a person who has high evaluation curiosity material can cause more in their knowledge than just waiting for the explanation from a lecturer. Having an adequate facilities can support the students to find out more about symbolical biotechnology in health and pharmaceutical major. That facilities is accessing the internet, library and learning environment. A student who have a low score of EC does not increase the field of health and pharmaceutical biotechnology outside class. The students who has this category already feel satisfied with the explanations that provided what he got from his lecturers. The students who have high EC shows can be enjoy in exploring new ideas as well as the subject of biotechnology foreign about the field of health and pharmaceutical (Litman 2008).

Exploration performed by an observance of a lecturer, following discussions, and ask for the problem of biotechnology health and pharmaceutical including lecture or emerge from the community. Unfortunately, the lab work biotechnology health and pharmaceutical did not applied in the students of biology education. So, the experience of learning students in lab work is lack. Students who have low score will turned his attention on anything else. this behavior appropriate with an items i-d scale epistemic curiosity number 1 and 3.

Students who have high EC score will find the interesting in the biotechnology health and pharmaceutical. Based on interviews, one of the interest things of students is that the virus could be used as an order to create a vaccine. Vaccine used to treat certain diseases. The majority found interestingly students biotechnology health and pharmaceutical can become the solution to the problem in a society. Find out other studies informassion in new insights on biotechnology health and pharmaceutical in accordance with items i-d scale epistemic curiosity number 2.

The most matter of biotechnology health and pharmaceutical is an abstract things. Not all of the material invisible that require technology to ease in observation or analysis. The one which is DNA technology. Students who have very high or lofty EC score will enjoy discussion of an abstract concept to find out an answer or solution about the biotechnology health and pharmaceutical. Discussion is done in outside class or schedule. Discussion done with a friend, brother level or enough lecturers who concerned in . A student who have a low or very low EC score do not enjoy a moment to find out a solution on the issue of biotechnology the field of health and pharmaceutical. They tended to discuss another than the field of health and pharmaceutical biotechnology. The enjoy activities discussion was imaged in i-d scale number 4.

Students who have high EC score without having been an answer or solution in trouble biotechnology health and pharmaceutical, they will feel unsatisfied. It takes a long time even hour to hour just to find a solution. Students who have high EC always thingking about the best solution as the answer. The long time that their used is to find more references, discussion and others to get a solution. Sutarman et al. (2016) stated that the person with the big curiosity will find out more information on natural phenomena that observed to produce science. That behavior explain i-d scale number 6 and 7.

Students who have high EC will feel frustrating if they cannot give a solution about the health and pharmaceutical biotechnology (i-d scale number 9). On the contrary, students who have low EC score did not care about the issue of biotechnology health and pharmaceutical. They spent much of their time to address the problem of biotechnology health and pharmaceutical. Students who have high EC score, they will evaluate about biotechnology health and pharmaceutical and trying to solve the problem around them. Curiosity makes the people can solve any problem and ideas in their mind. The result in accordance with Arnone et al. (2011) and Santoso (2011) stated that people become more positive to comment on everything when it has a deep understanding.

Cognitive understanding student biology show low averages results reaching 38,8 %. Most students are in these criteria. Almost all respondents show low results. There are many factors that affect the results of study in cognitive understanding. Several factors are interest and the motivation to study, how the way teaching's method, the characters of lecturer, the quiet and comfortable class,

the facilities is used (Aritonang 2008), and oversight of the students (Arnone et al. 1994). Cognitive understanding shows Table 2.

Table 2 Cognitif understanding Biology's students in health and pharmaceutical biotechnology

Data	Result
Lower score	0
Higher score	12
Score average	5,82
Value average	38,8
Criteria average	low

Interest and motivation affect learning outcomes. Each person has a different interest and the motivation to study. The motivation and desires to study come from inside of the person or outside.this occurred to students. A motivation that have the greatest role is the motivation that arising from the inner self (Aritonang 2008). The results of cognitive understanding cognitive show that students are less motivated to study biotechnology the field of health and pharmaceutical. Daud (2012) and Dev (1997) corroborating that getting the high emotional intelligence and motivation learn, it becomes the higher learning outcomes.

The student's background affects the results of study. It referred to family and environment (Aritonang 2008). Students who came from families who aware in education will provide the motivation to get high result in learning. A families who have realized that having higher education can motivate the student to study and understand the importance of the learning.if the family have a low recollection in education, so to improve the carrier study results of student, they have to increase a motivation by themselves. One of the things that support motivation is curiosity.

The results of interview said that the way in teaching affects student's learning outcomes. Systematically in learning more comprehensible for students. The characters of lecturer contribute teaching methods. The lecturer are demanding to seek information other than by diktat class being one action that might improve the EC. Aritonang (2008) stated that one of the factors that affect learning outcomes is teaching methods and characters of teacher.

Now, biotechnology is interactive learning through the presentation and confirmation of lecturers. Learning in two directions like this has created the opportunity for mutual discussion and looking for the presentation material. Hopefully, the students become a self directed learner. It means, led the students that studying is necessary for their own so as to have a business and the motivation to understand the health and pharmaceutical biotechnology information by themselves.

Biology department consists of two program of study, such as biology of education and biology. The number of biology of education is higher than the biology one. Biotechnology's major is not being the one that focus in the colleges. So that, not all of students understand about biotechnology especially in health and pharmaceutical. There is a differenciation between biology of education and the biology one in learning process biotechnology. It is a practicum (labolatorium work). It would be better if lab work gives in all program study whether biology of education or the biology one because this activities will improve the student's skill and they need a material not only the theoretical but also the practical or it called by learning by doing. This reason is for supporting the low results of cognitive understanding.

The second purposes in this research is analyze correlation epistemic curiosity (EC) and cognitive understanding of biology’s student in the biotechnology of health and pharmaceutical major. Correlation EC and cognitive understanding of biology’s student is done by quantitatively and qualitatively. This analysis has a mutual support results.

In quantitative, the value of correlation (r) EC and cognitive is 0,208 (weak category). The number of r square is 4.3%. It shows a value of determination. It means, the EC explain that 4.3% is to reach understanding cognitive. Indirectly explained that the EC is needed for students to reach a cognitive understanding. Grossnickle (2016) stated that in educational context, curiosity is believed to be add for supporting the outcomes and conducting the process of teaching. But, there is another factors that 95,7 % had played a role in achieving cognitive understanding. This factor derived from the inner self (internal) or outer (external) of respondents. The quantitative analysis can be seen in Table 3.

Table 3 Analysis of epistemic curiosity and cognitive understanding correlation biology’s student in health and pharmaceutical biotechnology

Correlation	N	R	R Square	Adjusted R Square	Std. Error of the Estimate
EC- cognitive understanding	246	,208	,043	,039	2,318

Correlation analysis qualitatively indicated by Table 4. The results of the analysis correlative qualitatively shows that not all categories can be found in the field, categories: C, D, H, and P. The large number of the students is the J category who have a high EC but the cognitive understanding is low. The majority of students are at the level of the EC lofty or very high but having low cognitive. It means, the results of the correlation quantitatively and qualitatively show the same results.

Table 4 student amount in every category of EC and cognitive understanding correlation biology’s student qualitatively

Categori	EC	Cognitive	Amount
		Understanding	
A	very low	very low	7
B	very low	low	4
C	very low	high	0
D	very low	very high	0
E	low	very low	8
F	low	low	38
G	low	high	9
H	low	very high	0
I	high	very low	23
J	high	low	99
K	high	high	40
L	high	very high	2
M	very high	very low	4
N	very high	low	4
O	very high	high	8
P	very high	very low	0
Total			246

Learning approach relating to the curiosity and cognitive learning outcomes. Arifin & Muluk (2017) stated that if the students who have a deep learning approach, they will have a high self-authorship but if the students who do not have a deep learning approach they will have a low self-authorship. The impact of low self-authorship is low learning outcomes. The results of this study is accordance with that statement.

Learning environment affect learning outcomes. It consists of the atmosphere of the class , friends , and facilities in learning. A comfortable and conducive condition is one of the things to understand the process of learning and discussions (Aritonang 2008). Having good friend will give a positive impact in learning. The facilities in the biology major is complete and adequate to study. It consists of the library which has many references, there is a wifi which can be used to browsing on the internet, classes and also other learning facilities to support learning process. This kind of situation will support the student's curiosity, but all of students not understanding the concept of biotechnology yet.

CONCLUSION

Based on the research, it can be concluded that epistemic curiosity of biology students in developing biotechnology is high in health and pharmaceutical major. Meanwhile, Epistemic Curiosity (EC) and the cognitive ability of a student (health and pharmaceutical major) show a weak correlation.

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