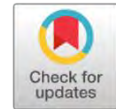


Research Article

Students' curiosity profile in excretion system topic taught using authentic inquiry learning



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ABSTRACT

Curiosity is a basic important aspect encourages students in finding various information which, in turn, aid them to encompass the concept learnt. This descriptive research aimed at elaborating the curiosity profile of junior high school students in science learning, particularly in excretion system topic who were taught using the authentic inquiry learning. This research was conducted at SMP Negeri 14 Yogyakarta with 32 of eight graders as the subjects. The instrument used was curiosity response questionnaire. The data obtained was analyzed using percentage. The results showed that the average of curiosity achievement obtained was categorized as strong (75%). However, the comparison of implementations between the authentic inquiry learning and the other learning models are needed to get more comprehensive information.



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INTRODUCTION

Education has an important role in building a nation (Cinnirella & Schueler, 2018; Ramdhani, Ancok, Swasono, & Suryanto, 2012). It is an important element for human life as it can shape superior human resources in the future (MacCann, Fogarty, & Roberts, 2012; Pop & Giurgulescu, 2015). Improvement of superior human resources in the future is vital to improve the quality of education, one of which is by improving the quality of learning (Artuner, Uzun, & Ilbars, 2012; Gajardo & Carmenado, 2012; Reisner et al., 2017). Learning is an effort in the delivery of knowledge (Cannady, Vincent-Ruz, Chung, & Schunn, 2019), organizing and creating a learning environment system with various methods (Falloon, 2019; Sanchez & Weber, 2019). So that students can carry out the activities of learning effectively and efficiently and can achieve optimal learning outcomes (Gerritsen-van Leeuwenkamp, Joosten-ten Brinke, & Kester, 2019; Zender & Reile, 2018). It also involves information and environment that are planned in a way that makes it easy for students to learn

(Galeshi & Bolin, 2019; Suprihatiningrum, 2013; Yurkofsky, Blum-Smith, & Brennan, 2019). Moreover, learning is an activity that is carried out to initiate, facilitate, and increase the intensity and quality of learning in students (Hamalik, 2010; Kyriakides, Stylianou, & Eliophotou Menon, 2019). It is a combination that is composed of the elements of humans, materials, facilities, equipment, and procedures that influence each other to achieve the ultimate goals (Hammami, Saeed, Mathkour, & Arafah, 2019; Murtonen, Gruber, & Lehtinen, 2017).

Today learning must be under the demands of the 21st-century. The 21st-century learning is simply interpreted as learning that provides 21st-century skills to students, namely 4C which includes: (1) communication; (2) collaboration; (3) critical thinking and problem solving; and (4) creative and innovative (Darling-Hammond, 2006; Greenstein, 2012; Trilling & Fadel, 2009). To realize this, the teacher as the spearhead of learning must be able to plan and implement a quality learning process (Darling-Hammond, 2006). The teacher must have good process skills in learning. Process skills can be interpreted as teacher skills in provide meaningful and enjoyable learning experiences for students (Candrasekaran, 2014; Min, Rashid, & Nazri, 2012). It also provides student-centered learning and stimulates them to solve problems. The teacher's role is not only as a learning resource but also as a facilitator (Habók & Nagy, 2016; Yap, Neo, & Neo, 2016). One of these process skills is the ability of teachers to determine learning models that can accommodate the 21st-century skills to students, for example, the application of authentic learning.

Authentic learning is a learning approach that enables students to explore, discuss, and build meaningful concepts and relationships which involve real problems and projects that are relevant to them (Ciolan & Ciolan, 2014; Saariaho, Toom, Soini, Pietarinen, & Pyhältö, 2019). By providing real experiences for students and connecting them with appropriate material, authentic learning approach will make learning meaningful for students so that they are expected to be able to absorb more knowledge to the maximum (Iucu & Marin, 2014; Keinänen, Ursin, & Nissinen, 2018; H. Wang, Sui, Luthans, Wang, & Wu, 2014). Based on the involvement of students in authentic learning, the inquiry approach or approach through inquiry is suitable to be applied. The use of an inquiry approach that is oriented towards authentic learning guides students to find facts and concepts in science related to problems in daily life.

Based on the observation result at SMP Negeri 14 Yogyakarta, science learning was not conducted using an authentic learning approach. This is indicated by the fact that teachers were emphasized the materials by using PowerPoint. During the learning activities, there were still several students who were playing around so that not all groups could complete the tasks from the teacher and only a few students who asked questions and gave responses in the discussion process. In addition, students were reluctant to ask questions when they did not understand the learning materials. Science learning must provide a learning process that can accommodate competence (cognitive), attitude (affective), and skills (psycho-motor) of the student (Cannady et al., 2019; Trefil & Hazen, 2016; Tursinawati, 2015). Therefore, science learning is not only limited to understanding the concepts of science but also involves other activities to optimize the attitudes and skills of students through a process of discovery to find out about science systematically (Budwig, 2015; Chiappetta & Koballa, 2010; Timostsuk & Jaanila, 2015). The objectives of science learning include instilling curiosity and positive attitudes towards science, the environment, technology, and society (Kumpulainen & Rajala, 2017). Attractive and enjoyable science learning can foster student motivation and curiosity (P.-H. Wang, Wu, Yu, & Lin, 2015). Thus, to support science learning activity, an authentic learning approach is needed (Jamalzadeh & Shahsavari, 2015), to facilitate students in conducting an inquiry process (Gillies & Rafter, 2019; Jerrim, Oliver, & Sims, 2019; Jiang et al., 2018).

The observation result also indicates that the lack of curiosity in students. On the other hand, the character of students' curiosity is an important part of the character of students that need to be developed in learning (Cain, 2019; Clark, Harbaugh, & Seider, 2019; Lamnina & Chase, 2019; Mussel, 2013; Sakaki, Yagi, & Murayama, 2018; Uiterwijk-Luijk, Krüger, Zijlstra, & Volman, 2019). Curiosity can arise when looking at objects or the like (Hagtvedt, Dossinger, Harrison, & Huang, 2019). If this attitude of curiosity can be put to good use, then humans will increasingly understand various kinds of concepts in natural phenomena (FitzGibbon, Moll, Carboni, Lee, & Dehghani, 2019; Sakaki et al., 2018). The attitude of curiosity makes people more aware of the truth of the concept (Baniyamin & Rashid, 2016; Mussel, 2013). Therefore, the teacher needs to apply the proper learning model to be able to trigger student curiosity so that the goal skills can be achieved, one of them using inquiry learning approach.

The inquiry learning approach is the process of defining and investigating problems, formulating hypotheses, designing experiments, finding data, and drawing conclusions of those problems (McNew-Birren & van den Kieboom, 2017; P.-H. Wang et al., 2015). The inquiry learning provides students' understanding by developing their social skills (Wheeler, Maeng, & Whitworth, 2013; Yudarwati, 2019). Besides, the inquiry approach specifically can be applied in laboratory activities which is the best way as a center of learning in developing the students' ability in thinking and facilitating their scientific attitudes, especially inquisitive attitude (Dobber, Zwart, Tanis, & van Oers, 2017; Şimşek & Kabapinar, 2010; Veloo, Perumal, & Vikneswary, 2013).

Based on the previous description, it can be concluded that authentic inquiry learning is a contextual learning approach based on real problems in daily life that direct students to collaborate on real activities using a variety of learning resources. Based on these problems, the researchers are concerned and motivate to study the curiosity profile of junior high school students with authentic inquiry learning in science learning. This research is a descriptive study that can later be used and aims to describe the attainment of a curious attitude by using an authentic inquiry learning approach in excretion system topic.

METHOD

This research was conducted at SMP Negeri 14 Yogyakarta in excretion system topic. The research subjects were 32 students of class VIII B. The data collection instrument used in this study was a questionnaire of curiosity attitude with 12 positive statements and 12 negative statements (related to excretion system topic) which were developed using curiosity attitude indicators as presented in Table 1. Furthermore, the correlation of the authentic inquiry learning approach stages to facilitate the attainment of a curiosity attitude is presented in Table 2. The data were collected through a questionnaire of curiosity attitude to determine the attainment of students' curiosity attitude.

Table 1. Aspects and indicators of curiosity attitude

No.	Aspects	Indicators
1.	Enthusiasm in finding the answers	a. Responding quickly to the asked questions b. Eagerly finding the answers from various sources
2.	Attention to the observed objects	a. Focusing on the objects of observation b. Concentrating on the observed objects
3.	Enthusiasm in the scientific process	a. Responding quickly to the sequence of the scientific process b. Showing enthusiasm in the scientific process
4.	Asking each activity step	a. Asking for an explanation of the activity steps that have not been understood

Table 2. The correlation of the authentic inquiry learning approach stages and the curiosity attitude aspects

Authentic inquiry learning stages		Curiosity attitude aspects
1.	Contextual problems	Enthusiasm in finding the answers
2.	Collaboration	Attention to the observed objects
3.	Using learning resources variation	Enthusiasm in finding the answers
4.	Formulating problems	Enthusiasm in finding the answers, enthusiasm to the scientific process
5.	Formulating hypothesis	Enthusiasm in finding the answers, enthusiasm to the scientific process
6.	Designing experiments	Enthusiasm to the scientific process, asking each activity step, attention to the observed objects
7.	Finding data	Attention to the observed objects, enthusiasm to the science process
8.	Drawing conclusion	Enthusiasm in finding the answers, enthusiasm to the science process

The attainment of curiosity attitudes was analyzed by calculating the average actual score and then converting it to a scale value of four (Widoyoko, 2013) as presented in Table 3. Furthermore, the qualitative value of the questionnaire was converted into a quantitative value questionnaire according to the provisions in Table 3.

Table 3. Provisions for converting qualitative value into quantitative value

Answer choice	Statement score	
	Positive	Negative
Strongly agree	4	1
Agree	3	2
Disagree	2	3
Strongly disagree	1	4

The quantitative data that have been obtained were then analyzed by using the following steps: (1) Counting the total score of each respondent. (2) Calculating the percentage (Purwanto, 2009) of respondents' answer score by using the Equation (1). (3) Converting percentage to value by category in Table 4. The level of students' curiosity can be identified with quantitative data that have been obtained and then converted into qualitative data (interval data). The reference to converting scores into categories was adapted from Riduwan (2009).

$$NP = \frac{R}{SM} \times 100\% \quad (1)$$

Where NP = Percentage value; R = Obtained total score; and SM = Maximum score value.

Table 4. Provisions for converting score to category

Interval (%)	Category
80-100	Very Strong
60-80	Strong
40-60	Medium
20-40	Weak
0-20	Very Weak

RESULTS AND DISCUSSION

The achievement of students' curiosity attitude is described in [Table 5](#). Each stage of the authentic inquiry learning approach can accommodate the students' curiosity attitude aspect, will be explained in detail as follow.

Table 5. The achievement of students' curiosity attitude

Aspects	Average score (%)	Maximum score (%)	Category
Enthusiasm in finding the answers	75	100	Strong
Attention to each observed object	76	100	Strong
Enthusiasm in the scientific process	75	100	Strong
Asking each activity step	74	100	Strong
Average	75	100	Strong

Stage 1: Contextual problem

The contextual problem stage that is related to the aspect of enthusiasm in finding the answers obtained a score of 75% with a strong category ([Table 5](#)). In line with [Amar and Mullaney \(2017\)](#) research which state that the existence of a problem encourages a student to be more motivated in finding the answers in the form of solutions. The use of contextual problems, related to excretion system topic, offers some challenges for students in the learning process ([Sitorus & Masrayati, 2016](#); [Zabit, 2010](#)). Some research also revealed that contextual problems will engage the students' attention ([Bell, 2010](#); [Chiang & Lee, 2016](#)) and make their curiosity straighten up ([Sitorus & Masrayati, 2016](#)). Thus, this stage will increases students' learning activities.

Stage 2: Collaboration

[Table 5](#) showed that the collaboration stage which is related to the aspect of attention to the object obtained a score of 76% with a strong category. This is consistent with the research results of [Liao, Chen, and Shih \(2019\)](#) which revealed that collaboration provides opportunities to interact in a more productive exploration process of the object of observation. The collaboration stage can provide opportunities for active learning practices ([Mora, Signes-Pont, Fuster-Guilló, & Pertegal-Felices, 2020](#)). This stage involves the active participation of students and minimizes differences between individuals ([Liao et al., 2019](#); [Mora et al., 2020](#); [Tissenbaum, 2020](#)). Therefore, in this stage students' attention increases in line with the existence of collaborative discussion activities.

Stage 3: Using learning resources variation

In the third stage, using variations in learning resources, is related to the aspect of enthusiasm in finding the answers obtained a score of 75% with a strong category. The use of variations in learning resources is able to direct students in finding learning materials and facilitate students in answering questions ([Huang, Han, Li, Jong, & Tsai, 2019](#); [Shi, 2019](#)). At this stage, students are given the opportunity to use various learning resources related to excretion system topic to find solutions to the problems. This activity accommodates students' literacy skills to solve problems which at the same time spark their enthusiasm in finding solutions.

Stage 4: Formulating problems

Based on the result ([Table 5](#)) the formulating problems stage which is related to the aspect of enthusiasm in finding the answers and scientific process (both aspects reach strong category). At this stage, students work together in formulating problems that are in line with the main problems presented at the beginning of learning. The existence of a problem encourages a person to be more motivated in finding the solutions and it increases the students' learning activities ([Amar & Mullaney, 2017](#); [Sitorus & Masrayati, 2016](#); [M. Wang, Wu, Kinshuk,](#)

Chen, & Spector, 2013). Students will get used to formulating problems and finding out how to solve those problems. This is one way to build students' thinking skills and their curiosity attitude.

Stage 5: Formulating hypothesis

The next stage, formulating hypothesis, is also related to the aspect of enthusiasm in finding the answers and scientific process obtained a score of 75% with a strong category (Table 5). Students are directed to formulate provisional estimates as answers to problems that are formulated. According to Rahmaniar, Haris, and Martawijaya (2015), if students understand carefully the formulation of the problem, they can establish a basic assumption which will then be tested for truth through experimental activities. Formulating a hypothesis requires a specific, testable, and predictable statement driven by theoretical guidance and/or prior evidence (Dobber et al., 2017; Trna, Trnova, & Sibor, 2012; P.-H. Wang et al., 2015). Therefore, students will be forced to respond actively so that an active science learning process is created.

Stage 6: Designing experiments

In the sixth stage, designing experiments, is related to the three curiosity aspect, namely asking for each activity steps (strong category), enthusiasm in the scientific process (strong category), and attention to the observed objects (strong category) as presented in Table 5. Sabirin, Muris, and Yani (2016) state that the ability to design experiments is the most important part of the science learning process. This ability consists of preparing experimental steps and preparing tools and materials, observing objects, collecting data, and interpreting data to test the hypothesis. Students are allowed to develop experimental designs to test hypotheses that have been formulated (Chu, Reynolds, Tavares, Notari, & Lee, 2017; Tindangen, 2018; Trna et al., 2012; P.-H. Wang et al., 2015). Thus, in this stage, students can develop their curiosity, especially in asking for each activity steps, enthusiasm in the science process, and attention to the observed objects.

Stage 7: Finding data

Furthermore, finding data stage is related to the aspect of attention to the observed objects (strong category) and the aspect of enthusiasm in the scientific process (strong category). Students look for supporting evidence to answer the statement of the problem that has been made (Tindangen, 2018; Trna et al., 2012). This activity can be in the form of experiments inside and outside the laboratory. Students will collect as much data as possible to answer the problem formulation (related to excretion system topic) and test their hypotheses. According to Dobber et al. (2017) when students conduct experiments according to their own design, this will support their thinking abilities. This finding data activity can enhance the students' attention and enthusiasm in the scientific process.

Stage 8: Drawing conclusions

The final stage, drawing conclusions, is related to the aspect of enthusiasm in searching for answers and the scientific process which both categorized as a strong category. Students are allowed to explain the evidence gathered and connect the explanation with knowledge obtained from the experimental process (Dobber et al., 2017; Jiang et al., 2018; Trna et al., 2012; P.-H. Wang et al., 2015). This is in line with the research result of Astiani, Martawijaya, and Hustim (2015) which showed that the ability to conclude is the most important part of the learning process of science. As with the ability to conclude, the students will be able to understand better the essence of the problems in the science learning process and be able to interpret observation data correctly.

Based on the research result, it revealed that the score achievement of all aspects of students' curiosity attitudes results in an average score of 75% with a strong category. This shows that science learning with an authentic inquiry learning approach allows students to hone the students' ability in building new knowledge and developing scientific attitudes, especially the curiosity attitude based on real experience that they have done. The authentic inquiry learning approach facilitates students to explore, discuss, and build meaningfully concepts and relationships which involve real problems and projects that are relevant to them (Ciolan & Ciolan, 2014; Dobber et al., 2017; Saariaho et al., 2019; Şimşek & Kabapınar, 2010; Veloo et al., 2013).

In addition, practicum activities become the best way as a center of learning in developing the ability and experience in thinking and facilitating students' scientific attitudes, especially the curiosity attitude (Lamina & Chase, 2019; Uiterwijk-Luijk et al., 2019). This is also confirmed by Cain (2019) and Clark et al. (2019) which states that the students' curiosity attitude is an important part of their characters that need to be developed during the learning process. The curiosity attitude can arise when observing the objects or the like. If this curiosity attitude can be put to good use, then humans will increasingly understand various kinds of concepts in natural phenomena (FitzGibbon et al., 2019; Hagtvedt et al., 2019; Sakaki et al., 2018). The curiosity attitude makes people more aware of the truth of the scientific concept (Baniyamin & Rashid, 2016; Mussel, 2013). The

results of this study indicate that authentic inquiry learning has a significant effect on student curiosity. However, the comparison of implementations between the authentic inquiry learning and the other learning models are needed to get more comprehensive information.

CONCLUSION

Based on the data description and discussion, it can be concluded that the achievement of the curiosity attitude results averages obtained a score of 75% with a strong category. Curiosity can be developed through science learning with an authentic inquiry learning approach. Based on the discussion in this research, it is suggested that the observation sheet is necessary to be used in data collection and also the questionnaire before and after learning. Comparative classes with other approaches are also needed to determine the significance of the research results obtained.

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