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Student's naturalist intelligence in studying high plant botanicals by inquiry model

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ABSTRACT

Naturalist intelligence was the expertise in recognizing and classifying various species of flora and fauna from an individual environment. The principle of learning of Plant Botany in higher education was the application of the process of observing, measuring, testing, estimating, analyzing, comparing, classifying, experimenting and making conclusions by applying the principle of learning by doing. Therefore naturalist intelligence was very necessary. This study aims to determine the naturalist intelligence of students in the High Plant Botany course. This study uses a quantitative descriptive approach with the Action Research model Inquiry method. The study was conducted on 40 students of high plant botany Biology Education Subjects PMIPA Department FKIP Lambung Mangkurat University with 12 practicums as many times as measurements (1st practicum Cycadopsida Class, 6 Class Magnoliopsida practicum and 12 Liliopsida Class labs). The character of naturalist intelligence was measured using student worksheets which include; 1) Sensitivity to plants, 2) Expertise in differentiating members of plant species, 3) Ability to recognize the existence of plant species, and 4) Ability to map relationships between several plant species. Data were analyzed descriptively. The results of the study showed that there was a tendency to decrease the value of students' naturalist intelligence in high plant botany courses from repeated observations made. Based on the categories in a row with a high category (grades 75.6-90.5) as many as 21.3% of students, medium category (grades 60.6-75.5) as many as 76.6% students, and low categories (grades 40, 6-60.5) as many as 3.1% of students.

Introduction

Gardner (2000) suggests a theory, that the minimum intelligence possessed by a person includes eight different intellectual abilities called the multiple intelligences theory. The eight bits of intelligence consists of: linguistik intelligence, logical mathematical intelligence, spatial intelligence, bodily-kinesthetic intelligence, musical intelligence, interpersonal intelligence, intrapersonal intelligence, and naturalist intelligence.

Gardner further explained that naturalist intelligence is the ability to recognize, see differences, classify, and categorize what he saw or met in nature or in his environment. Being naturally intelligent can help humans in the past to recognize patterns and changes around their environment to survive. This intelligence is located in the part of the brain responsible for recognizing patterns, forming subtle relationships, especially in areas of the brain that can capture the perception of sensors that are accurate, such as the separation and classification of certain objects.

Some researchers report on the role of naturalist intelligence in relation to success in the world of education. Hanafin (2014) states that naturalist intelligence can make students more interested and more motivated in conducting practical activities. Derakhshan & Faribi (2015) stated that naturalist intelligence can improve the ability to improvise language both in speaking and writing. Mustafa, Jado, & Onoz (2014) who reported, that, naturalist intelligence students can improve student learning outcomes in learning light.

Some jobs that require naturalist intelligence are biologists or environmental conservation experts. This was also stated by Sreenidhi & Helena (2017) who stated that naturalist intelligence is the basic thing for studying plants and animals. This is evidenced by the results of a study by Walukou, Jahidin, & Makukulau (2016) on the contribution of naturalist intelligence to produce biology learning achievement of class X high school students with a high enough category.

Naturalist intelligence is the expertise in recognizing and classifying various species of flora and fauna from an individual environment. The point is the ability of humans to recognize plants, animals, and other parts of the universe. This intelligence is right to help in understanding biology lessons easily. Naturalist intelligence includes; 1) Sensitivity to an organism, 2) Expertise to differentiate members of species, 3) Ability to recognize the existence of a species, and 4) Ability to map relationships between several species (Armstrong, 2017).

Chatib (2014), explains Biology is a subject that needs the ability to recognize, differentiate, and classify flora and fauna. In learning, the right intelligence to facilitate students in understanding biology well is by honing naturalist intelligence. Suherman (2012), that students with high naturalist intelligence have higher average ability to solve environmental problems compared to students who have low naturalist intelligence.

Researches on naturalist intelligence have so far been carried out both in early childhood education and elementary school up to college. As done by Juniarti (2015) about increasing naturalist intelligence through field visit methods in early childhood. Walukou et al. (2016) about the contribution of naturalist intelligence to biology learning achievement in class X high school students. Sari (2012) about differences in the naturalist intelligence of Biology students based on participation in study groups. Lismaya & Widiantie (2017) about the application of plant morphology learning through Outdoor Activities can improve students' naturalist intelligence.

The principle of learning Botany or Plant Taxonomy in higher education is the application of IPA processes (observing, measuring, testing, estimating, analyzing, comparing, classifying, experimenting and making conclusions) by applying several principles of student-centered learning, namely: learning by doing (learning with real experience), developing social skills, problem-solving, curiosity, and imagination and encouraging students to continue learning. One of the principles of learning can be done by the Inquiry method. Therefore naturalist intelligence is very necessary.

The reality on the ground of the learning principles of High Plant Botany has not been effective, because the material that is considered less attractive to students, abstract and seems to be memorized a lot, for example regarding plant systems, plant species and scientific names of plants, so that student interest for learning to be reduced which impacts on student learning outcomes (cognitive) that are less than optimal. As reported by Dharmono (2016), that learning the Plant Taxonomy gets a response from students: 1) boring (80%) because the material is raw and does not develop, 2) is not attractive (75%) because most material is memorized, 3) difficult understood (95%) because the terms used are mostly in Latin, and 4) the

methods used are monotonous, namely lectures and classical practicums (80%).

Several studies to explore the character of students in learning high plant botany have been carried out, including Sriyati (2011) who applied formative assessment to explore and increase caring for plants, realize the greatness of the Creator, learn to manage time, be more creative, innovative, disciplined, thorough, and manage yourself. Dharmono, Muslimin, & Prabowo (2015) developed a key dichotomy in the form of "Coded Fan" to improve student learning outcomes in high plant botany courses. Dharmono (2016) develops Habits of Mind learning strategies to improve student learning outcomes in high plant botany courses. The results of these studies indicate that various efforts have been made to improve the ability of students to study high plant botany.

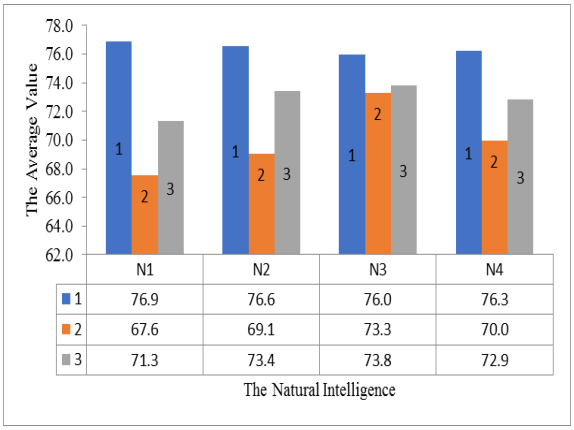
This study aims to determine the naturalist intelligence of students, especially in the High Plant Botany course as a reference for increasing student mastery in learning high plant botany.

Method

This study uses a quantitative descriptive approach. The quantitative approach used in this study is to use the Action Research method Inquiry learning model. This research was conducted on high plant botany Biology Education participants in the PMIPA Department, FKIP, Lambung Mangkurat University, Banjarmasin, with 40 students. The character of naturalist intelligence is measured using criteria adapted from Armstrong (2017) which using student worksheets include; 1) Sensitivity to an organism, 2) Expertise to differentiate members of species, 3) Ability to recognize the existence of a species, and 4) Ability to map relationships between several species. Learning activities are carried out using the Inquiry syntax, namely; 0rientasi, formulating problems, formulating hypotheses, collecting data, testing hypotheses, and formulating conclusions. The research data was taken from the results of students' ability to carry out practical activities in learning using inquiry methods at the stage of observation of plants 3 times the measurement of 12 practicums carried out (1st practicum Cycadopsida Class, 6 Class Magnoliopsida practicum and 12 Liliopsida Class labs). Data analysis used descriptively on the results of average student scores made on the graph and categorized based on criteria adapted from Sugiyono (2016) which included; 1) a score of 90,6-100 is very high, 2) a score of 75,6-90,5 is high, 3) a score of 60,6-75,5 is medium, 4) 40,6-60,5 is low, and 5) a score of 0-40.5 is very low.

Results and Discussion

Data obtained from practicum results data using the Inquiry approach to the naturalist intelligence of students in high plant botany courses taken three times repetition can be seen in Figure 1.



	N1	N2	N3	N4
1	76.9	76.6	76.0	76.3
2	67.6	69.1	73.3	70.0
3	71.3	73.4	73.8	72.9

Figure 1. Average naturalist intelligence trends

Based on Figure 1, it can be seen that the average value of students in the first to second meetings increases, but the decline seems to be from the third meeting to the fourth meeting. This was allegedly caused by the boredom of students in learning high plant botany. This is thought to be caused by a lack of curiosity of students about the plants observed. Such conditions indicate that the naturalist intelligence possessed by students in learning high plant botany has not grown well. As explained by Dharmono et al. (2015), that one of the causes of high plant botany courses is less attractive to students, because the learning is monotonous which results in students becoming bored. This is also reported by Maskour, Alami, & Agrraki (2016), that studying Plant Taxonomy is something that is difficult for students to do. The impact of the still low naturalist intelligence will lead to efforts to explore and increase caring for plants, realize the greatness of the Creator, learn to manage time, be more creative, innovative, disciplined, thorough, and self-managing

students will also be low. As reported by Dolati & Tahriri (2017), that naturalist intelligence has a strong enough relationship to emotional, motivation and student learning outcomes.

While the average data on naturalist intelligence results from 40 students in high plant botany courses were taken 3 times the measurement of practical activities (1st practicum Cycadopsida Class, practicum 6 Magnoliopsida Class, and practicum 12 Liliopsida Class) can be seen in Table 1.

Table 1. Percentage of Average Naturalist Intelligence of Students at high plant botany Courses

Indicator	Result (%)				
	VH	H	M	L	VL
Sensitivity to plants	0,0	30,0	67,5	2,5	0,0
The expertise differentiates members of plant species	0,0	37,5	60,0	2,5	0,0
The ability to recognize the existence of plant species	0,0	7,5	90,0	2,5	0,0
The ability to map the relationships between several plant species	0,0	30,0	67,5	2,5	0,0
	0,0	21,3	75,6	3,1	0,0

Information:
VH: Very High, H: High, M: Medium, L: Low, VL: Very Low

Based on Table 1 above, it can be seen that the effort to find out the naturalist intelligence of students in high plant botany courses on the 4 indicators of naturalist intelligence measured, has not found the value of students who reached the very high category (score>90.5), but still dominated by students in the medium category (score 60.6-75.5) with an average of 75.5% or medium category. Meanwhile, reaching a high category only 21.3% of students. This shows that students in high plant botany courses do not have and develop their naturalist intelligence to study the subject, so the learning outcomes are not maximal. As reported by Suherman (2012), that students with high naturalist intelligence have higher average ability to solve environmental problems compared to students who have low naturalist intelligence.

Based on plant sensitivity indicators, the medium category reached 67.5% and the high category was only 30.0%. Meanwhile the indicator of expertise to differentiate members of plant species also shows that the ability of high plant botany student participants has not been able to optimally differentiate between species of one plant and other plants. This is thought to be caused by the ability of high plant botany participants to observe and record data carefully on the observed morphological characteristics of plants that have not been optimal so that their learning outcomes have not achieved maximum results. This was also reported by Suherman (2012), that the higher the students' naturalist intelligence, the higher their learning achievement. The results of this study reinforce the opinion of Gardner (2000), that the naturalist intelligence possessed by students provides opportunities and encourages students' curiosity to recognize patterns and phenomena found in nature and the environment.

Indicators mapping the relationship between several species of plants are also still dominated by students with the value of the medium category (score 60.6-75.5) as much as 67.5% of students, indicating that students' ability to classify plant species observed is also not optimal. This is certainly related to the indicator of sensitivity to plants so that the accuracy of observations can be carried out optimally, so it is certain to differentiate between plant species from one another to the maximum. This is also reported by Wardhani, Rondonuwu, & Sudarmi (2015), that critical observations will produce the ability to recognize, classify an object in nature. As stated by Fleetham (2006), that a person's potential to think and understand nature must be done with his ability to recognize and classify plants and animals and other aspects of their environment.

The indicators of recognizing the existence of plant species are also still dominated by students with a medium category score (score 60.6-75.5) as much as 90% of students, indicating the ability of students to understand the benefits of plants observed is also not optimal. This is due to the low awareness of students about the surrounding plants. Generally, students who are in touch with the surrounding

naturalist environment will be more concerned with the phenomena that exist in their environment. According to Yalmanci & Gözüm (2013), someone who has naturalist intelligence always thinks of naturalist references. This can be seen from its ability to see relationships and patterns in the naturalist world and interact with natural processes.

Some efforts to improve student learning outcomes have been carried out by several researchers including among them Gupta, Kandru, & Singh (2015) who develop active learning techniques in studying botany can improve learning outcomes but are still dominated by values with a medium category. Goldberg & Ingram (2011) which uses the concept map model and problem-solving in botany learning are also still dominated by values with the medium category.

Other researchers who made learning innovations to improve the naturalist intelligence of students, including those conducted by Lismaya & Widiantie (2017) apply plant morphology learning through Outdoor Activities to improve student naturalist intelligence. Ayesha & Khurshid (2013) who seek to improve student naturalist intelligence through the application of Study Skill. Mojares (2015) who applied oral communication to improve students' naturalist intelligence. Hajhashemi, Caltabiano, Anderson, & Tabibzadeh (2018) reported, that student naturalist intelligence can be improved by using videos in learning.

Based on the description above, it shows that efforts to improve students' naturalist intelligence in learning high plant botany need to find a solution so that students are truly capable of maximally recognizing, differentiating, and classifying flora as a form to increase caring for plants, realizing the greatness of the Creator, learning to manage time, be more creative, innovative, disciplined, thorough, and manage themselves.

Conclusion

Students' naturalist intelligence in learning high plant botany students tend to decline from each measurement with no value which reaches a very high category, but it is still dominated by the moderate category with an average of 75.5% of students on 4 indicators of naturalist intelligence measured. Meanwhile, the highest category was only 21.3%. This shows that students in high plant botany courses do not have and develop their naturalist intelligence to study the subject, so the learning outcomes are not maximal. Therefore it is necessary to find a solution so that students are truly capable of maximally recognizing, distinguishing, and classifying flora as a form to increase care for plants, realize the greatness of the Creator, learning to manage time, be more creative, innovative, disciplined, thorough, and manage themselves.

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