PlantCard: media innovation to increase the reasoning of plants

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Abstract. Education in accordance with the development of the 21st century one of which relies on the development of thinking skills. The ability to think critically is one of the basic thinking skills a 21st century student should possess. One of the key indicators of 21st century critical thinking skills is to use appropriate types of reasoning (inductive, deductive, etc.) in various situations. However, based on the results of field studies, students' reasoning abilities are generally low. In addition, students' knowledge of the diversity of plants is low. For that, it needs innovative learning media, one of which is PlantCard. This study is a preliminary study, to analyze students' reasoning ability. Research data were collected by reasoning test and questionnaire of student response to PlantCard media. The results of the preliminary study of the seven reasoning processes measured showed that, the most dominant reasoning achievement was comparing (39.28%), followed by classifying (17.85%) and abstracting (17.85%), constructing support (15.18%), deductive reasoning (7.14%), and error analysis (3.57%). The reasoning ability that has not yet emerged is inductive reasoning (0%). The results of the preliminary study of students' responses showed that they felt helpful after studying the seed plants with the PlantCard media.

1. Introduction

Education is one effort to develop and improve quality human resources. Education in accordance with the development of the 21st century relies more on developing skills that include thinking skills, problem-solving skills and communication skills that support optimization in the educational attainment process [1].

The ability to think critically is one of the basic thinking skills which a 21st century student should have. Critical thinking skills are the basis for developing other thinking abilities. One of the main indicators of critical thinking ability of the 21st century is to use various types of reasoning (inductive, deductive, etc.) that fit the situation [2]. This reasoning ability is very important for students to have, because with reason it will develop the ability to think critically and problem-solving skills.

Indonesian students' reasoning abilities are generally low. This can be seen from the 2015 Science for International Student Assessment (PISA) program for science which gained 403 points score. From 72 participating countries by 2015, Indonesia occupies the 10th lowest position [3]. The PISA results indicate that students do not yet have the ability to understand the content, problem-solving abilities,
reasoning ability and sufficient communication skills, in addition to the less-than-optimal learning of science in schools [4].

The low ability of students' reasoning is caused by the lack of teachers in applying reasoning ability in classroom learning [5]. All aspects of student reasoning are still below 50% [6]. In detail, argumentation aspect gets 34.21%, knowledge aspect gets 40.13%, methodology aspect gets 32.24%, analysis aspect gets 32.56%, and conclusion aspect gets 31.53% [6]. Furthermore, the results of field studies show that students' reasoning ability is low because of the inability of students to find similarities and differences, to group, and generalize the results of grouping. Students always ask the teacher about the similarities and differences found. Furthermore, the determination of the similarities and differences made by students is often inaccurate. This is what causes students prefer to seek information via the Internet, so that practical activities undertaken are not effective and meaningful.

There are eight reasoning processes that help students to expand and perfect their knowledge [7]. Some of them are comparing, classifying, abstracting, inductive reasoning, deductive reasoning, constructing support, and analyzing error information or knowledge [7]. Students can expand and deepen their knowledge by adding new information features and making further connections [7].

So far, the learning that is applied in the school is still one way or in the form of knowledge transfer from teacher to students that focuses on the mastery of the material and not yet on life skill oriented aspect, so that the result of education is only seen from the students ability to memorize facts in short term [8]. It takes effort to bring realistic atmosphere that can connect between the knowledge taught and the real world situation of the students. Learning activities tend to be passive because generally still dominated by monotonous methods such as giving material through lecture method [8]. Lecture method is considered to be boring and will impact the learning materials provided to be boring. In addition, the ability of students in processing information is still inadequate so that it can impact the material given cannot be stored long (long term memory) [5].

Learning classification of plants in high school grade 10 aims to enable students to classify the types of plants based on their own morphological characteristics and benefits in daily life [3,8]. Plants need to be studied because plants serve as a source of life. Plants can photosynthesize to produce oxygen which is the main gas constituent needed by animals and humans to live. Furthermore, the plant functions as a habitat for animals, especially animals that live in the forest. In addition, plants serve as a leading indicator of climate change and as one of the main components of the oxygen cycle. Without plants, life will not happen. In Indonesia, there are many rare plants, but these rare plants are difficult to learn because the amount of plants are slightly and many of them are endemic in the region. Therefore, it needs a media in order to facilitate students to learn plants.

One alternative way to overcome the above problems is to use picture cards as a medium of learning on the material classification of living things. The use of picture cards is expected to make it easier for students to understand the material classification of living creatures and enable students to achieve better learning objectives. In some studies, a picture card or flashcard is a card that contains a collection of organisms of a particular group accompanied by a brief description of the characteristics of the group of living things [9]. Based on research carried out by Purnamasari the classical learning completeness gained by every class ≥ 91% with an average of ≥ 77 with inquiry learning with flashcard-assisted determination keys [9]. In addition, Rokiman's research shows that learning with picture cards can improve students' learning completeness up to 98% with the average value of 90 [10]. In a study of pharmaceutical identification cards on the Animalia concept, it shows that phylum identification cards can help students to identify animals and help students construct characteristics through inductive and deductive thinking. This medium can aid students' understanding and reduce student cheating in learning the determination key [11].

In this study the media of pictorial cards contains pictures showing the characteristics of each species from the roots, stems, leaves, flowers, until the fruit. Students can learn more concrete, comprehensive and profound seed material with the help of the picture card especially on the morphology.
2. Method
This research was conducted in one of the private high schools in Bandung. Research subjects consisted of 56 students of 10th grade MIPA, with purposive sampling technique. This study is a preliminary study to analyze students' reasoning ability, as well as students' response to PlantCard as a medium of classification of seed plants.

In this study, 56 students were given the essay to know the extent of their initial reasoning ability. After the test, they were divided into eight groups. In the first meeting, students learnt by using the original media. In the second meeting, students learnt by using the PlantCard media. After the learning, students were given a questionnaire to determine the role of the PlantCard media to study the classification of seed plants.

In the learning process using PlantCard media, students of each group were asked to observe the picture of some organ contained in the picture, then the students classified the plants according to the similarities and differences found. Here is an example of PlantCard used in the lesson.

![Sample PlantCard](image)

**Figure 1.** Sample PlantCard. Left, pepper plants (daily crops); right, red durian plants (endemic plants in Kalimantan).

3. Result and discussion

3.1. Reasoning ability
Based on Figure 2, generally students are still unable to reach the processes of reasoning. This is why students' reasoning ability is generally low. Percentage of achievement of reasoning processes is shown in figure 2. It is shows that students have not reached the reasoning processes well. From the seven reasoning processes measured, the achievement of the most dominant reasoning process is the ability to compare (39.28%), followed by the ability to classify (17.85%) and abstraction (17.85%), build support (15.18%), deductive reasoning (7.14%), and error analysis (3.57%). Furthermore, there is one reasoning ability has not been achieved by students that is the ability of inductive thinking (0%). Abilities to compare, classification and abstraction of students are quite high compared with other reasoning ability because students have been accustomed to perform the process at previous meetings. Students do not have the ability to build good supportive reasons yet. This happens because students provide supportive reasons based on previously acquired knowledge.
Based on the above explanation, students' reasoning ability can’t just appear but needs to be trained in both classroom and outside classroom activities. This is in accordance with the opinion of Brookhart which states that the ability to reason can be sharpened and developed at schools [12]. In addition, Rich states that the development of reasoning ability is a result of teaching and practice, which is done in a row [13]. The results of Lawson's study indicate that students' reasoning ability is improved after several practices and assignments that require reasoning ability to answer or complete the task or exercise [14].

3.2. PlantCard media
Before learning using PlantCard media, students firstly studied seed plants using original media. Previously, students were asked to bring some types of plants familiar with daily life such as corn, turmeric, chili and passion fruit to school. However, many students who do not carry the plant on the grounds do not know the form of these plants. They claim to know only the fruit, because the fruit is found in daily life. This shows that the students' knowledge about the surrounding plants is still low. The explanation above according to Wandersee and Schussler are called plant blindness [15]. Some researchers have long concluded that the social and educational environment is responsible for the blindness plant that occurs in students. In education, for example, "zoo-chauvinistic" educators at all levels tend to use animal examples to teach basic biological concepts, whether in class, laboratory, or field [16]. The inability to see or care for plants in their own environment causes the inability to recognize the importance of plants in the biosphere and human affairs [16].

Media PlantCard is one of the visual media that presents images of various organs in plants. With PlantCard media, students can see how the roots, stems, leaves, flowers and fruits of different types of plants are without presenting the original media in the classroom. Results of student responses after studying the classification of seed plants using PlantCard are presented in Table 1.

Table 1 shows the use of PlantCard in the study of seed plants is generally responded positively by students. The result of the respondent's percentage of 56 students indicates that their reasoning ability is generally increased after learning using PlantCard (86%). In addition, students generally responded positively that their knowledge of the plant is increased (86%), and the effectiveness of classroom learning is increased (61%) after learning using the PlantCard media. This is in accordance with the opinion of Sadiman et al. (2006) which states that the media can be used as a means to stimulate fun learning so as to it facilitates concentration and help the thinking process of students [17]. This is also stated in the research of Sutjiono that the media is needed by teachers in the delivery of learning materials [18].

| Indicator Response       | Percentage of Response "Yes" (%) | Percentage of Response "No" (%) |
|--------------------------|----------------------------------|---------------------------------|
| Reasoning ability        | 82                               | 15                              |
| Knowledge of plants      | 86                               | 11                              |
| Effectiveness of learning| 61                               | 36                              |
4. Conclusion

Student reasoning abilities and students' knowledge of plants are generally low. The reasoning that most students achieved is comparing, while the reasoning ability that students do not achieve is inductive reasoning. The PlantCard media can be used as a medium to help students familiarize themselves with plants, and help students to reach every stage of reasoning.

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References

[1] Hapsari N D 2016 Meningkatkan Pengetahuan dan Keterampilan Metakognisi Peserta Didik Melalui Bahan Ajar Berbasis Konstruktivisme-Metakognitif (Postgraduate Thesis: Universitas Pendidikan Indonesia)

[2] Pacific Policy Research Center 2010 21st Century Skills for Students and Teachers (Honolulu: Kamehameha Schools, Research & Evaluation Division)

[3] Kemdikbud. 2016 Peringkat dan Pencapaian PISA Indonesia Mengalami Peningkatan. [online] Available:https://www.kemdikbud.go.id/main/blog/2016/12/peringkat-dan-capaian-pisa-indonesia-mengalami-peningkatan [2 Februari 2018]

[4] Putri A E 2014 Analisis Kemampuan Penalaran Siswa Sekolah Menengah Atas Serta Kemunculan Penalaran Pada Laporan Praktikum Biologi (Postgraduate Thesis: Universitas Pendidikan Indonesia)

[5] Adriani M 2016 Beban Kognitif Dan Kemampuan Penalaran Siswa SMA Sesuai Gaya Belajar Pada Praktikum Klasifikasi Angiospermae Melalui Media Virtual (Postgraduate Thesis: Universitas Pendidikan Indonesia)

[6] Daryanti E P, Rinanto Y and Dwiastuti S 2015 Jurnal Pendidikan Matematika dan Sains Tahun III No. 2 pp 163-168

[7] Marzano R J and Pickering D J 1994 Dimension of Learning (USA: ASCD Publication)

[8] Prajayanti S S R 2015 Reduksi Didaktik Bahan Ajar Tumbuhan berbiji Sebagai Upaya Mengendalikan Beban Kognitif Siswa SMA Sesuai Gaya Belajar (Postgraduate Thesis: Universitas Pendidikan Indonesia)

[9] Purnamasari H, Rahayuningsih M, and Chasnah 2012 Unnes Journal of Biology Education 1 (3), 228-235

[10] Rokiman 2013 Penggunaan Media Kartu Bergambar Untuk Meningkatkan Aktivitas dan Hasil Belajar Siswa Pada Materi Klasifikasi Hewan (Postgraduate Thesis: Universitas Lampung)

[11] Putri L O L 2016 Jurnal Pendidikan Biologi Indonesia 2 (1) pp 31-38

[12] Brookhart S M 2010 How to Assess Higher-order Thinking Skills in Your Classroom (Virginia: ASCD)

[13] Rich J D Jr, William F, and Willis D 2011 Hispanic Journal of Behavioral Science 33 (2) pp 261-277

[14] Lawson A E 2000 A The American Biology Teacher 62 (7) pp 482-495

[15] Wandersee J H and Schussler E E 1999 Preventing Plant Blindness The American Biology Teacher 61 (2) pp 82-26

[16] Allen W 2003 Plant Blindness BioScience 62 (10) pp 926

[17] Sadiman A, Rahardjo R, Haryono A, Rahardjito 2006 Media Pendidikan: Pengertian, Pengembangan dan Pemanfaatannya (Jakarta: Rajawali Pers)

[18] Sutjiono T W A 2005 Jurnal Pendidikan Penabur No.04/Th.IV/Juli.