Students’ academic self-concept the constructivism learning model

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Abstract. Students’ beliefs and attitudes towards mathematics influences learning process. In other words students who have a positive disposition towards mathematics tend to study and learn mathematics seriously and confidently. Students have the abilities to assess and perceive, and assess themselves in solving mathematical problem, comparing their learning process with other students, communicating with teachers or other students, academic achievement. Self-perception related to academic aspects is called academic self-concept (ASC). This study aims at investigating aspects of students’ ASC in the constructivism learning model. This study is experimental in nature and was conducted in a public senior high school in Bogor, West Java, Indonesia. The sample of this research consists of 10th-grade students. The instrument used in this research covers ASC questionnaire, and the data were analyzed by using one-way ANOVA. The results show that learning models encourage students to construct mathematics knowledge independently through activities in real-world observation, contextualization, and collaborative influencing the self-assessment in grade and effort dimension, peer-evaluation of academic ability, self-evaluation with the external standard.

1. Introduction
Affective aspects have become the focus of the teacher’s attention in learning mathematics besides cognitive aspects. In general, affective domains are divided into three main categories, namely: emotions, attitudes, and beliefs. Emotional aspects tend to be unstable and difficult to investigate. Attitudes are defined as behaviors or actions, feelings, or thoughts that show students’ dispositions [1]. Changes in attitude are slower than emotions, but the change in attitude is faster than belief. As with emotions, attitudes involve positive or negative feelings, and the intensity of attitudes tends to be slower than the intensity of emotions.

Students’ beliefs and attitudes towards mathematics are strongly influenced by their experiences in learning mathematics. Students who have a positive attitude towards mathematics tend to be more interested and try to study mathematics seriously. For example, mathematics is a lesson that I mastered compared to other lessons taught at school. If students have a positive response to these statements it will have an influence on students’ sincerity in learning mathematics.

Students have the ability to assess and perceive themselves regarding ability in solving the questions posed, leaning styles, ways of learning with other students, communication with teachers or other students, and academic achievement. Self-assessment related to academic aspects is called academic self-concept.
Academic self-concept (ASC) is defined as a person's perception regarding his academic abilities which are formed through experience and interaction with the environment[2]. ASC includes the assessment or perception of a person regarding his academic performance or one's perceptions of his academic abilities developed through specific endeavors and academic interactions[3].

Students must know and be able to assess their academic abilities so that students have undaunted behavior in facing problems or challenges in school assignments. Students who have high ASC always try to develop their academic abilities, whereas students who have low ASC will know how to increase their academic potential within themselves and be able to motivate themselves independently. Positive ASC must lead to good academic achievement. This means that students with positive views about their academic abilities tend to engage in behaviors that are more related to academic achievement, including completing homework, studying for exams, and participating in class activities[4].

Some studies showed that ASC has an influence on academic achievement [5], there is a strong relationship between ASC and student interaction in the classroom[6], and ASC can be formed and developed through interaction students with teachers and other students [7]. Referring to the results of these studies, it is assumed that teacher-centered learning causes students to be academically negative because the learning process does not provide opportunities for students to be actively involved in the learning process.

The author assume that academic self-concept is strongly influenced by learning model given by teachers to the students. Therefore, this study focused on examining the academic self-concept of high school students in learning model with the paradigm of constructivism. The main idea of constructivism learning model is that knowledge is not passively accepted but actively constructed by students through teacher guidance. The Learning model of constructivist paradigm in this study is interpretation-construction design model and problem-based learning.

Interpretation-construction design model (ICON-model) was developed by [8]. ICON emphasizes the importance of students’ building interpretations from authentic observation, discussion of interpretations, reflection, analysis, and conclusion of interpretations [9]. The principles of ICON consist of observations in authentic activities, interpretation of construction, contextualization, cognitive apprenticeship, collaboration, multiple interpretations, and multiple manifestations [8, 10].

Problem-based learning is an instructional student-centered approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem[11]. PBL is considerably different from conventional learning where the teacher's role changes from the information provider to the facilitator, and the change in this role can be a difficult transition for many teachers [12].

2. Methods
This study is experimental research and was conducted in a public senior high school in Bogor, West Java, Indonesia. The sample of this research consists of 10th grade students. This study used posttest control group design. The experimental group was given interpretation-construction design model (ICON-model) and Problem-based learning while the control group was done with conventional learning.

Students’ Academic Self-concept (ASC) is obtained through questionnaire which consists of 40 items based on a a 4-point format Likert scale , ranging from Strongly Agree (4) to Strongly Disagree (1). These four choices are useful to avoid doubtful statements of student opinions that is put forward. As a consequence, there is no N (neutral) option in the student opinion scale used. ASC instruments adopted [13] include grade and effort dimension, study habits or organizational self-perceptions, peer-evaluation of academic ability, self-confidence in academics, satisfaction with school, self-doubt regarding abilities, and self-evaluation with external standards. The validity and reliability test of the instrument were 0.70 and 0.87 respectively. The data were analyzed by using one-way ANOVA.
3. Result and Discussion

The result showed that there was a significant effect of learning model on students’ academic self-concept at the $p < 0.05$ level for the three conditions [$F(2, 297) = 14.94, p = 0.024$]. The result found a statistically significant value in ASC test. This result will be later analysed using Tukey post hoc test. This test is designed to compare one condition to the others. This test will compare students’ academic self-concept test after they had undergone a series of learning treatments involving the ICON-model, problem-based learning, and conventional learning. Post hoc comparisons using the Tukey HSD test indicated that the students who learned using the ICON-model ($M = 131.18$, $SD = 13.35$) and problem-based learning ($M = 130.71$, $SD = 11.30$) had significantly higher mean scores of academic self-concept than those who learned using conventional learning approach ($M = 122.24$, $SD = 16.84$). However, student academic self-concept who work under the ICON-model did not significantly differ from those who work under problem-based learning.

The result of the test data with regard to the aspects of academic self-concept is presented in Table 1.

| Aspect of ASC                  | ICON-model | Learning Model | Conventional |
|--------------------------------|------------|----------------|--------------|
| Grade and effort dimension     | 31.18      | 30.26          | 27.58        |
|                                | (77.95%)   | (75.65%)       | (68.95%)     |
| Study habits                   | 22.03      | 21.21          | 21.10        |
|                                | (78.68%)   | (75.75%)       | (75.60%)     |
| Peer-evaluation of academic ability | 23.15      | 22.00          | 21.76        |
|                                | (77.17%)   | (73.33%)       | (70.53%)     |
| Self-confidence in academics   | 28.35      | 28.18          | 27.88        |
|                                | (76.62%)   | (76.16%)       | (75.54%)     |
| Satisfaction with school       | 16.24      | 15.35          | 15.10        |
|                                | (76.2%)    | (73.1%)        | (73.02%)     |
| Self-evaluation with external standards | 28.09      | 27.00          | 22.88        |
|                                | (80.26%)   | (77.14%)       | (65.3%)      |

Based on Table 1, it can be seen that students' responses to the aspects of grade and effort dimension, peer-evaluation of academic ability, self-evaluation with the external standard showed significant differences compared to the other aspects of ASC. The student’s response towards the grade and effort dimension include, for example, I am proud of the value of test exam; I did not try hard to solve the problem until the answer was reached; and, I did not ask the teacher about the incomprehensible material being studied. The statements submitted to the aspects of the peer-evaluation of academic ability cover, for example: My friend argues that I never complain when at the end of the lesson the teacher gives assignments to be completed at home; The group mates argue that I have the ability to lead discussions; and My friends in one group judge that I don't have the ability to sketch a graphics from tables. The statements related to the aspect of self-evaluation with external standard are, for example, I am able to explain well compared to group mates; I am not calm when I get criticism from my teacher when I explain wrong answers compared to my peers; and, I am better than my friends in solving the questions given by the teacher. Students’ responses who work under ICON-model and PBL tend to be higher than those who work under conventional learning. The differences are caused by several factors, among others, when learning using ICON-models and PBL students build knowledge independently through activities of real-world observation, contextualization, scaffolding, and collaboration.

Group discussions are sometimes only dominated by students who have high abilities. In other words, students who have low abilities tend to be passive. However, all group members are actively involved in discussion activities. In discussion activities students can carry out activities such as exploring various information needed, communicating, reflecting on other students’ ideas, or taking conclusions. Collaborative learning helps develop students' ability to communicate when they explain their opinions. In addition, in collaborative learning students must develop clear ideas or ideas about the concepts that are being used and verbally communicate them to other students.
Discussion activities in conventional learning tend to be monotonous between teachers and students. Ideally, discussions occur when the teacher gives the opportunity for students to ask questions about material that they do not understand. Although the teacher can provide opportunities for other students to answer the questions, students who try to answer or explain are frequently interfered by students who have high academic abilities and good communication skill. Therefore, the discussion process in conventional learning is less effective so that learning seems to be passive. Students' perceptions are strongly influenced by the interaction among students, teachers, other students, and teaching materials. This was confirmed in the study [3] which concluded that a person's perception of academic ability is strongly influenced by student interaction with the teacher, interaction among students, interaction with the material. Students' academic self-concept depends on social and dimensional comparison processes [14]. Social comparison is a process in which students compare their abilities on one subject material with other abilities, while dimensional comparisons refer to a process in which students compare their abilities in one lesson with other lessons taught in school.

Learning using the ICON model, problem-based and conventional learning involve the role of the teacher. Teachers who are too dominant in learning affect students' self-assessment of their abilities. Conversely, learning which emphasizes the interrelationship between concepts that are being studied with the real-world and role of the teacher as a facilitator provides a stimulus to students towards self-confidence. This is reinforced by [15] which explains that the relationship between students and teachers has an impact on student learning achievement, learning motivation, behavior, and cognitive skills. Teacher describe students as engaged problem solvers in problem-based learning. Students’ activities of seeking to identify the problem situation needed for a solution will lead them to become self-directed learners. In other words, self-directed learning can influence students grade and effort dimension.

Students' beliefs and attitudes towards mathematics are influenced by experience in learning mathematics. Therefore, students who have a positive attitude towards mathematics tend to be more interested and try to study mathematics seriously. The academic self-concepts depend on students social and dimensional comparisons. Social comparison is that students compare their abilities with other students abilities on same lesson, and dimensional comparisons students compare their abilities to one lesson with other lessons taught in school. Constructivism learning uses students' initial knowledge of various situations to help build new knowledge through the process of internalizing students (cognitive constructivism) and through helped the others (social constructivism). Learning characteristics that connect learning situations with certain physical situations or with other ideas. In other word, the characteristics of learning such as this is a very valuable initial capital in the formation of student.

Student activities in observing authentic situations, discussing, listening to explanations for solving problems by other students. Discuss and debate various interpretations so students will gain cognitive flexibility. Students are increasingly enthusiastic about learning because their opinions feel valued and students are more willing to ask questions; students are more courageous in expressing opinions both in group discussions and group discussions. When students are proud of their task completion and enthusiastic about challenging tasks is a reflection of positive academic self-concepts.

4. Conclusion
Constructivist learning emphasizes active-constructive processes carried out by students in building new knowledge. Teacher-centered learning causes student academic self-concept to be negative. This is because the learning process does not provide opportunities for students to be actively involved in the learning process. Therefore, learning that involves the interaction of students and teachers and other students have an influence on the academic self-concept achievement. A good relationship among students and teachers can affect students' self-assessment. Conversely, when the teacher is not responsive to the needs of students can cause students' self-assessment to be negative because students are considered incompetent or not academically feasible.

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