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Students' Engagement in Scientific Approach Based Learning and Its Effect on Students' Readiness to Compete

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Abstract: *To be exist in the 21st century, every student must be able to compete. Therefore, every educator should carry out learning activities to develop the students' skills to compete. The implementation of scientific approach based learning is intended to encourage the students' high order thinking and to improve their skills to compete. This study examines the effects of the implementation of scientific approach based learning to the development of students' readiness to compete. The research was conducted at the high schools (SMA/SMK) in Jombang, East Java, which have been implementing scientific approach based learning. The subjects in this study were students in 10th grade academic year 2013/2014 and 11th grade academic year 2014/2015. The research sample was determined by using the technique of multi-stage sampling and clustering. The total numbers of samples involved in this study were 95 students in grade 10 academic year 2013/2014, and they become the same sample for the academic year 2014/2015. To describe the students' engagement in scientific learning and students' readiness to compete, teachers observe the various indicators of students' engagement in learning and the indicators of each student readiness to compete. The proportion coefficient is calculated by comparing the number of students who show indicator, divided by total students and multiplied by 100%. The data analysis was conducted by using the factorial design variance analysis or two-way analysis of variance to detect the influence and interaction among the variables associated with the students' readiness to compete. The results showed that the implementation of scientific approach based learning has a positive influence on the growth of students learning activities including 11 indicators. They are engaged in activities, attention, observing, high order thinking, the courage of giving opinions, initiative to present, teamwork, pride in the task implemented, originality opinions, orientated to the best work, and commit to the task. The improvement of students' activities influences positively on the students' readiness to compete including 12 indicators. They are need for achievement, apply knowledge, critical thinking, problem solving, working collaboratively, time management, creative thinking, self-efficacy, initiative, mastery of information technology, responsibility, and communication. Thus educators are expected to apply scientific approach based learning to encourage the growth of students' skills to compete.*

Key words: *scientific approach, engaged in learning, the skills to compete*

I. Introduction

Education is a miniature of society. The future scenarios of political, social, cultural, and economic sectors will depend on the contributions of the students of our school today (Singh, 1991: i). It means what the quality of life of a nation in the future can be projected from education activities ongoing at this time. The quality of educational activities in schools, ranging from primary education, secondary, and higher education; will greatly affect the quality of life of a nation. Teachers and students should be encouraged to involve in the best learning, because that is the starting point of the civilization progress of a nation.

The best learning will be able to produce qualified human resources who are able to compete in the global era. Qualified human resources are those who have the various skills needed to answer the challenges of the times. Therefore, the presence of qualified human resources will determine the ability of many countries in the world to win the competition in the global era.

Educators are expected to familiarize the students to develop the various skills needed in the 21st century. Various skills need to be developed by students to be able to compete in the 21st century are skills to use information technology, literacy, self study, communication and collaboration, critical thinking and problem solving, creativity and innovation (Pacific Policy Research Centre, 2010).

To compete in the 21st century, every country in the world must be supported by innovative and creative human resources (Barkema, et.al., 2002). Suyanto (2015) in his study stated that creativity and innovation contribute to the excellence of the country by 45% and 25%. This data shows the importance for any educational institution to carry out learning activities directed to develop the creativity and innovation of the students.

To this moment, the skills of creativity and innovation of human resources in Indonesia have not developed optimally. Data released by the Global Innovation Index 2014, it shows that the skills to innovate Indonesian human resources have a coefficient of 31.81. It ranks 87 out of all the countries in the world, and it ranks 12 in Asia Pacific. The index of creativity and talent of Indonesian human resource in 2011 ranked 76 and 80 (Florida, 2011).

In order not to be left behind from other countries, the development of creativity, innovation, and the variety of other skills are manifestation of the skills to compete and these became the main programs of educational activities in Indonesia. Based on this program, scientific approach based learning is implemented. Scientific approach based learning is implemented through the activities to observe, to question, to reason, to try and to communicate. The activity of learning is student-centered learning implemented mainly using problem-based learning, project based learning, and discovery learning (Ministry of Education and Culture, 2013).

The preliminary study conducted by the researcher showed that teachers and students were comfortable and more accustomed to using the scientific approach in the learning activities. The students argued scientific approach based learning activities allow them to absorb the subject, even they have to study very hard. Based on the observation of the researcher in several schools, it showed that the intensity of student engagement in the activities of scientific approach based learning vary considerably. It depends on the capacity of each student. This happened because before implementing the scientific approach based learning, student learning activities highly depend on the delivery of subjects by teachers through lectures. The dependence of students to teachers makes students can not directly be engaged in the scientific approach based learning intensively.

Based on the explanation above, there are four research questions posed, (1) can the implementation of scientific approach based learning improve students' learning activities?, (2) how is the development of students' learning activities since they are engaged in scientific approach based learning? (3) can the implementation of scientific approach based learning improve students' skill to compete?, (4) how is the development of students' skill to compete since they are engaged in scientific approach based learning?

The results of this study are expected to be used as a fundamental for preparing smart human resources who have the skills to compete in the 21st century. In addition, the results of this study are also useful for evaluating the effectiveness of the implementation of K-13 in preparing smart and competitive human resources as the vision of the Ministry of Education and Culture Republic of Indonesia. In terms of scientific developing, the results of the study are also useful to examine the relevance of the scientific approach as one of learning approaches in the 21st century.

II. Student Engagement

Student engagement in the learning activities needs to be assessed. The most important reason for the assessment is to ensure that students are learning (Middle States Commission on Higher Education, 2007:62). Fredricks, et al. (2011) defined students engaged primarily by observable behaviors such as participation and time on task. Fredricks, et al. (2011) incorporated affective aspects in their conceptualization of engagement. The study by Fredricks, et al. (2004) has revealed the aspects of cognitive engagement, such as students' investment in learning, perseverance in the face of challenges, and use of deep rather than superficial strategies. Meanwhile, a study conducted by Miller, et al. (1996) includes self-regulation as a component of a cognitive engagement.

The activeness of the students in the school can be seen on the degree of their engagement in learning activities. The students who are active in school activities are those engaged in learning activities. While the passive students in the learning activities are those who disengaged in learning activities (Connell, 1990; Skinner & Belmont, 1993). Fredricks, et al. (2011) states that engaged students show behavioral involvement in learning and positive emotional tone; they persevere in the face of challenge. Conversely, disengaged students are passive, do not try hard, are bored, give up easily, display negative emotions, such as anger, blame, and denial.

In this study, the engagement of students in their learning will be assessed in three dimensions; there are the dimensions of behavioral, emotional, and cognitive. Behavioral engagement can be seen from the participation and involvement in academic, social, and various extracurricular activities (Fredricks, 2011; Fredricks, et al., 2004). Emotional engagement focuses on the extent of the positive or negative reaction to teachers, classmates, academics, and school. Positive emotional will encourage students to study hard and involve in learning activities in the classroom actively (Fredricks, 2011). While cognitive engagement is defined as the student's level of investment in learning; it includes being thoughtful and purposeful in the approach to school tasks and being willing to exert the effort necessary to comprehend complex ideas or master difficult, skills (Fredreicks, et al., 2011).

III. Scientific Approach Based Learning

The learning process which is only full with the activities of memorizing and reading concepts without being reinforced with critical thinking skills eventually will only produce a stutter generation. The busy learning with memorizing activities makes the subjects students learned is like "fairy tale" which are not relevant to what is happening in their environment. At such conditions, the students are not really studying knowledge. They learned nothing more than a "story" of knowledge. According to the explanations of the Working Group on Teaching Evolution; Board on Science Education; Division of Behavioral and Social Sciences and Education; National Academy of Sciences (1998), that cannot be based on empirical evidence are not a part of science.

Scientific approach based learning conducted in order for students used to apply critical thinking. The students are encouraged to question the true information and knowledge which are being examined and studied. Testing the true information and knowledge is done with empirical facts and data based accurately. The process of finding facts and data is done through several activities, including: observation, formulating questions based on the issues, collecting the data which are relevant to the problem, making a series of correlation among the data, formulating hypotheses, examining the correlation among the data, evaluation and analysis, discussing the results of the analysis with peers and educators, and publishing the results of the study.

The Ministry of Education and Culture of the Republic of Indonesia (2013) explains there are four steps in the scientific approach based learning. *The first step* in the activities of scientific approach based learning is through the observation of an event, phenomenon, or the problems that occurred in the relation of the subject. It can be done by using problem-based learning. The data from the results of observations will be used as the basis for conducting the next activities.

The second step, the students ask questions of what, why, how an event, a phenomenon, and problems can occur and correlate between one to others. The answers of a lot questions can be used by students to construct the correlation between theoretical concepts that have been studied, facts, and data, and used as the basis for formulating the activities in the next step.

The third step, the students formulate and test hypothesis. The formulation of hypothesis is developed and tested based on the study of theoretical concepts, observation of an event, a phenomenon, and the observations that have been made by the students. By formulating hypotheses, the students learn to correlate between the concepts, facts, data, and events one to others. The correlation between concepts, facts, data, and events can be implemented in the form of project activities. This kind of learning activities is undertaken by the project-based learning approach.

The fourth step, the students evaluate and analyze the project of activities and discuss with peers and instructors. The project of activities developed should be logic and the level of validity is testable. The project of activities implemented does not always produce a "product" as expected. It means the project of activities developed could be a project that is "wrong" and "failed". The failure to execute the project of activities tends to encourage the students to attempt to find a better new way of working. This is the essence of learning by discovery learning approach. The students are encouraged to evaluate the effectiveness of the project of activities and it is intended to find and create a better project of activities. Thus, in this stage, the students are taught to conduct a research and developing, which is the main foundation for the growth of creativity and innovation.

Those four steps of scientific approach activities are carried out by the students through some activities, they are observing, questioning, reasoning, trying and communicating. Learning activities can be done with a combination of problem-based learning, project based learning, and discovery learning. In practicing, learning activities can be done by engaging a variety of activities and learning approaches simultaneously. It means that each of the students learning activities will develop the skills to observe, to question, to reason, to try and communicate. Applied learning approach is the integration between problem based learning, project based learning, and discovery learning. This is the essence of learning which is intended to build a holistic intelligence of the students.

Therefore, students' engagement in the scientific approach learning can theoretically be seen from the dimensions of behavioral, emotional, and cognitive (Fredricks, et al., 2004). From the behavioral dimension, students' engagement in scientific approach learning is assessed from the intensity of students' participation and the quality of student activity in observing, questioning, reasoning, and communicating actively the results of thinking in learning activities in the classroom. The students' engagement from the emotional dimension is measured from the attitudes and perceptions of students by teachers, classroom, learning activities, and school in general. While cognitive engagement is measured from the student's level of investment in learning; it includes being thoughtful and purposeful in the approach to school tasks and being willing to exert the effort necessary to comprehend complex ideas or master difficult skills. (Fredreicks, Blumenfeld, and Paris 2004).

IV. Readiness To Compete

One's skills to develop the creativity and innovation will determine the success to face hard competition (Barkema, 2002). According to Piirto (2011), the skills to think, to act creatively and to innovate are the main assets that will determine a person to be able to compete in the 21st century. Piirto (2011) said that creative people will be encouraged to update knowledge and skills that have been mastered and always seek to explore knowledge in order to build more new knowledge and skills. According to Kasali (2005), the creative person is always compelled to tear down the knowledge and skills mastered to be replaced with more new knowledge and skills.

Piirto (2011) describes a variety of creative skills needed in the 21st century, and divides creative skills into three elements, skill to think creatively, creative performance with others, and innovative behavior. The skill to think creatively is marked with a person's skill to use a wide range of idea creation technique, create new and worthwhile ideas, and elaborate, refine, analyze and evaluate their own ideas in order to improve and to maximize creative Efforts. The skill to work creatively with others is characterized with the skill to develop, implement, and communicate new ideas to others effectively; Be open and responsive to new and diverse perspectives, incorporate group input and feedback into the work, demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas, view failure as an opportunity to learn, understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes. While the skill to implement innovations is characterized with the skill to act creative ideas to make a tangible and useful contribution to the filed in which the innovation will occur. Based on the study conducted by Piirto (2011), a person who has any skill to think creatively is the person who is openness to experience, risk-taking, tolerance for ambiguity, self-discipline, and group trust.

Prianto (2013) found five factors that are expected by the work providers in Indonesia. They include a strong work motivation factor, mature individuality, social skills, work attitude, and skills in the work. In other words, those five factors can be indicators of readiness to face the competition. Furthermore, Prianto (2013) said those 5 factors can be grown through scientific approach based learning.

The study by Prianto (2015) shown that the new graduates are not really ready to work. The graduates are considered weak in terms of basic skills and a range of practical skills, including communication skills both orally and written and skills to critical thinking, skills to problem solving, professionalism, work attitude, team work and collaboration, working in diverse teams, applying technology, and leadership and project management. Jackson (2010; 2013) identified 41 skills needed to be possessed by the graduates to be able to compete in global markets, as shown in Table 1.

Table 1. Forty-one skills identified by Jackson (2010; 2013)

Task requirements	Threshold competencies	Distinguishing competencies	
	Ethic and Responsibility		
1. Graduate level	Written communication	Oral communication	Initiative
Application and use of technology	Information management	Team-working	Adaptability and change management
Problem solving	Operating globally	Organizational skills	Emotional Intelligence
Decision management	Intellectual ability	Interpersonal skills	Political skill
Operating in organizational environment	Lifelong learning	Continuous improvement management	Self-efficacy
Multi-tasking	Disciplinary expertise	Meta-cognition	Reliability
2. Higher level	Business ACUMEN	Cultural and diversity management	Stress tolerance
Project management	Works experience	Autonomy	Attention to detail
Meeting management	Numeracy	Critical thinking	Entrepreneurship
Coaching	Professionalism / work ethic	Leadership skills	Creativity
	Accountability		
	Life experience		

To create graduates who have the skills needed in a global era as recommended by Jackson (2010.2013), the students, ranging from primary and secondary education; as early as possible should be accustomed to learn how to develop the skills required in the 21st century. Therefore, the learning activities in schools should be directed to strengthen basic skills and practical skills. The learning activities is consequently not enough only done with the activities of memorizing the material but also should encourage students to observe, analyze, string concepts, construct, and communicate the products that have been produced. Learning activities is not only through lectures, but also should emphasize the scientific approach based learning; for example by integrating methods of problem based learning, project based learning, and discovery learning.

The development of information technology and computers has very rapidly changed the pattern of working from the manual activity to the automatic one. Economist predict that as technology continues to advance, computers will be programmed to tackle more and more tasks that only a human can perform now (Jerald 2009:6). This trend is supported by the study of Levy & Munarne (2004), they explains that computer technology has shifted the position of people in various areas of work, especially any work related to sales activities, technicians, professionals, managers, administrators, and service. The contribution of the field of

information-service to economic activity in a span of 30 years between 1967-1997 increased from 36% to 56%. Jerald (2009) by quoting the Munarne opinion (2008) describes a job that requires the skills of expert thinking and complex communication between the years 1969-1998 respectively increased by 193% and 180%. These data give a message to the educational institutions in order to provide the skills learned to the learners to develop communication skills and increase expertise continuously as early as possible.

Based on the study of several experts, in this study, the students' readiness to compete is measured from 3 dimensions, as developed by the Council of Chief State School Officers; they are knowledge, skills, and dispositions; as the details shown in table 2.

Table 2. Various skills as indicators of skill to compete

Dimension		
Knowledge	**Skills**	**Dispositions**
Mastery of rigorous content and the facile application or transfer of what has been learned to complex and novel situations	The capacities and strategies that enable students to learn and engage in higher order thinking, meaningful interaction planning for the future	Socio-emotional skills or behaviors that associate with success in college, career, and citizenship
Common core state standards Career and technical education Other content areas & essential literacies Global competence Applied knowledge	Critical thinking Problem solving Working collaboratively Meta cognition & Self Awareness Study skills and learning how to learn Time management Creativity and innovation	Self-efficacy Initiative Resilience Adaptability Leadership Ethical behavior and civic responsibility Social Awareness and empathy Self-control

Source: Council of Chief State School Officers (2011:11)

Therefore, it can be stated that the readiness to compete means that the students exit senior high school qualified to enroll in high-quality postsecondary opportunities in college and career. This means that students have the readiness to compete are those that having mastered rigorous content knowledge and demonstrated Reviews their ability to apply that knowledge through higher-order skills, critical thinking, complex problem solving, working collaboratively, Self Awareness, learning how to learn, time management, creativity and innovation, self-efficacy, initiative, resilience, adaptability, leadership, civic responsibility, empathy, and communicating Effectively (Council of Chief State School Officers, 2011).

V. Research Hyphotesis

This study proposes a research hypothesis as follows: (1) the implementation of scientific approach based learning can improve the students learning activities, (2) scientific approach based learning can increase students engagement in learning activities, (3) the more intensive the students engaged in scientific approach based learning, the stronger students' skill to compete.

VI. Research Method

The research was conducted at the high school (SMA / SMK) in Jombang, East Java Indonesia, which has been carrying out scientific approach based learning. The subjects in this study were students in grade 10 academic year 2013/2014 and students in grade 11 academic year 2014/2015. Based on the data from Jombang Education Department, the number of high schools that implement consistently scientific approach based learning are 11 schools, consisting of 9 public schools and 2 private schools. The research sample was determined by using the technique of multi-stage sampling and clustering (Scheaffer, et al., 2012). The total numbers of samples involved in this study were 95 students in grade 10 academic year 2013/2014, and they become the same sample for the academic year 2014/2015. The use of the same sample is intended to know the development of student engagement in scientific approach based learning and the development of students' readiness to compete. The details of the sample as shown in Table 3.

Table 3. The Distribution of sample

Academic year	Gender		Specialization		Total
	Male	Female	Science	Social	
2013/2014	47	48	67	28	95
2014/2015	47	48	67	28	95

Source: The research sample, summarized by the researcher

Student engagement in learning activities and students' readiness to compete were measured by a 5 scale questionnaire (Anwar, 1998) and regarding to the study of Fredricks, et.al (2010). Student engagement in

learning activities are grouped ranging from the category of not fully engaged (score 1) to fully engaged (score 5). Students' engagement in scientific approach based learning is grouped in five categories: very poor, poor, moderate, strong, and very strong. While the students' readiness to compete was measured by using a questionnaire developed by the Council of Chief State School Officers (2011:11). The students' readiness to compete was grouped ranging from very not ready (score 1) to very ready (score 5). Thus the category of the students' readiness to compete consists of "very not ready", "not ready", "moderate", "ready", and "very ready". The questionnaire on student engagement in scientific approach based learning and the students' readiness to compete has been developed by the researcher and validity and reliability were tested. The result of tested validity and reliability for the questionnaire of student engagement in scientific learning had a Cronbach's Alpha coefficient of .773, while the questionnaire for the students' readiness to compete had a Cronbach's Alpha coefficient of .694.

The assessment of student engagement in scientific learning and the students' readiness to compete held for 4 times, it was at the end of the first semester and the second semester of academic year 2013/2014 and by the end of the third semester and fourth semester of academic year 2014/2015. This longitudinal study was needed to know the development of student engagement in scientific learning and students' readiness to compete.

Analyzing the data was done by using the factorial design variance analysis or two-way analysis of variance to detect the influence and interaction between the variables associated with the students' readiness to compete (Tabachnick & Fidell, 2007). By the technique of factorial design variance analysis, it was expected to detect the combination and interaction of various variables that had dominant influence on the students' readiness to compete. To describe the students' engagement in scientific learning and the students' readiness to compete, teachers observe the various indicators of student engagement in learning and the various indicators students' readiness to compete. Proportion coefficient was calculated by comparing the number of students who show the indicator, divided by total student and multiplied by 100%.

VII. Result

There are 11 indicators identified by teachers on students' engagement in learning and 12 indicators on students' readiness to compete during four semesters (see table 4).

Table 4. The Indicators of engagement in learning and readiness to compete

Semester	Engagement in learning	Proportion	Readiness to compete	Proportion
1	1. Engaged in activities	.42	1. Need for achievement	.55
	2. Attention	.74	2. Apply knowledge	.23
	3. Observing	.34	3. Critical thinking	.23
	4. High order thinking	.28	4. Problem solving	.25
	5. Giving opinions	.31	5. Working collaboratively	.28
	6. The initiative to present	.24	6. Time management	.52
	7. Teamwork	.41	7. Creative thinking	.23
	8. Proud of the results of the task	.60	8. Self-efficacy	.56
	9. Originality opinions	.30	9. Initiative	.67
	10.Oriented on best assignments	.23	10. Mastering information technology	.56
	11. Commitment to the task	.40	11. Responsibility	.67
			12. Communication	.27
2	1. Engaged in activities	.43	1. Need for achievement	.56
	2. Attention	.79	2. Apply knowledge	.36
	3. Observing	.55	3. Critical thinking	.45
	4. High order thinking	.38	4. Problem solving	.48
	5. Giving opinions	.56	5. Working collaboratively	.51
	6. The initiative to present	.35	6. Time management	.54
	7. Teamwork	.59	7. Creative thinking	.51
	8. Proud of the results of the task	.62	8. Self-efficacy	.61
	9. Originality opinions	.33	9. Initiative	.71
	10.Oriented on best assignments	.29	10. Mastering information technology	.61
	11. Commitment to the task	.42	11. Responsibility	.72
			12. Communication	.51
3	1. Engaged in activities	.59	1. Need for achievement	.61
	2. Attention	.84	2. Apply knowledge	.56
	3. Observing	.67	3. Critical thinking	.62
	4. High order thinking	.46	4. Problem solving	.55
	5. Giving opinions	.69	5. Working collaboratively	.66
	6. The initiative to present	.59	6. Time management	.57
	7. Teamwork	.71	7. Creative thinking	.69
	8. Proud of the results of the task	.64	8. Self-efficacy	.63
	9. Originality opinions	.43	9. Initiative	.77
	10.Oriented on best assignments	.34	10. Mastering information technology	.64
	11. Commitment to the task	.64	11. Responsibility	.74

			12. Communication	.67
4	1. Engaged in activities	.79	1. Need for achievement	.63
	2. Attention	.93	2. Apply knowledge	.73
	3. Observing	.79	3. Critical thinking	.76
	4. High order thinking	.52	4. Problem solving	.69
	5. Giving opinions	.83	5. Working collaboratively	.73
	6. The initiative to present	.88	6. Time management	.61
	7. Teamwork	.89	7. Creative thinking	.76
	8. Proud of the results of the task	.67	8. Self-efficacy	.67
	9. Originality opinions	.45	9. Initiative	.79
	10.Oriented on best assignments	.39	10.Mastering information technology	.66
	11. Committed to the task	.71	11. Responsibility	.75
			12. Communication	.86

Source: The results are summarized by researcher

In the first semester of academic year 2013/2014, the students' engagement in scientific learning was shown mostly on the indicators of attention (indicated by 74% of students) and commitment to the task (indicated by 60% of students). Other indicators shown by the students are less than 50%. Most of the students have not shown a strong behavior to the indicators of engaged in learning activities in the classroom, observing, giving opinion, high order thinking, teamwork, and initiative to present the results of the work.

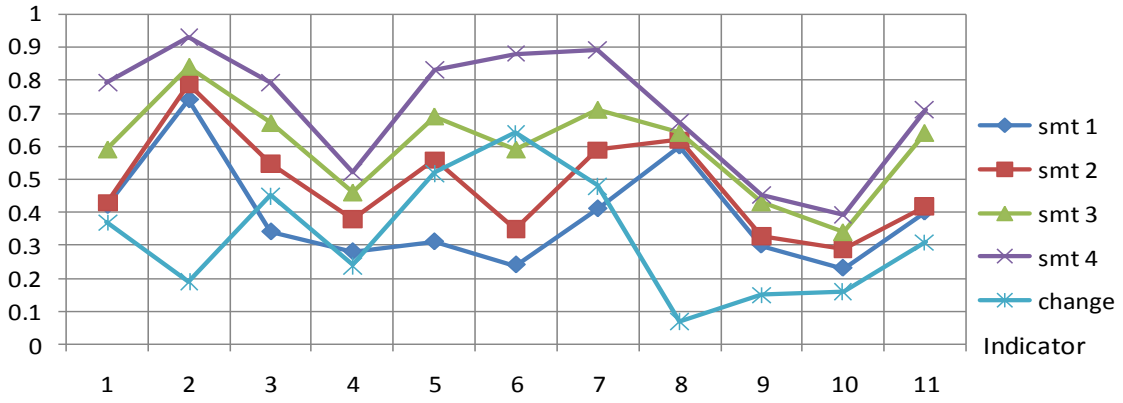

Figure 1. The development of the proportion of students' engagement in learning (11 indicators)

In the second semester of academic year 2013/2014, student engagement in scientific learning was shown mostly on the indicators of attention (indicated by 79% of students), observing (indicated by 55% of students), giving opinions (indicated by 56% of students), teamwork (shown by 59% of students) and committed to the task (indicated by 62% of students). Other indicators were indicated by less than 50% of students, including engaged in activities, high order thinking, and initiative to present the results of the work.

In the third semester of academic year 2014/2015, students' engagement in scientific learning was shown mostly on the indicators of attention (indicated by 84% of students), observing (indicated by 67% of students), giving opinions (indicated by 69% of students), teamwork (shown by 71% of students), committed to the task (indicated by 63% of students), engaged in activities (indicated by 59% of students), and initiative to present the results of the work (indicated by 59% of students). Other indicators shown by the students are less than 50%, including high order thinking, and proud of the results of the task.

In the fourth semester of academic year 2014/2015, students' engagement in scientific learning was shown mostly on the indicators of attention (indicated by 93% of students), teamwork (indicated by 89% of students), initiative to present the results of the work (indicated by 88% of students), giving opinions (indicated by 83% of students), observing (indicated by 79% of students), engaged in activities (indicated by 79% of students), committed to the task (indicated by 71% of students), proud of the results of the task (indicated by 61% of students), and high order thinking (indicated by 52% of students). The indicators that have not developed strongly are originality opinions and oriented to the best work.

Therefore, this study shows that the implementation of scientific approach based learning influence positively on students' engagement in learning, particularly to the indicators of engagement in a variety of learning activities, habits to do observation, the courage of giving opinion, initiative to present the results of the work, and skill to teamwork.

This study showed that the students' readiness to compete indicated by various indicators including need for achievement (1), apply knowledge (2), critical thinking (3), problem solving (4), working collaboratively (5), time management (6), creative thinking (7), self-efficacy (8), initiative (9), use of information technology (10), responsibility (11), and communication (12).

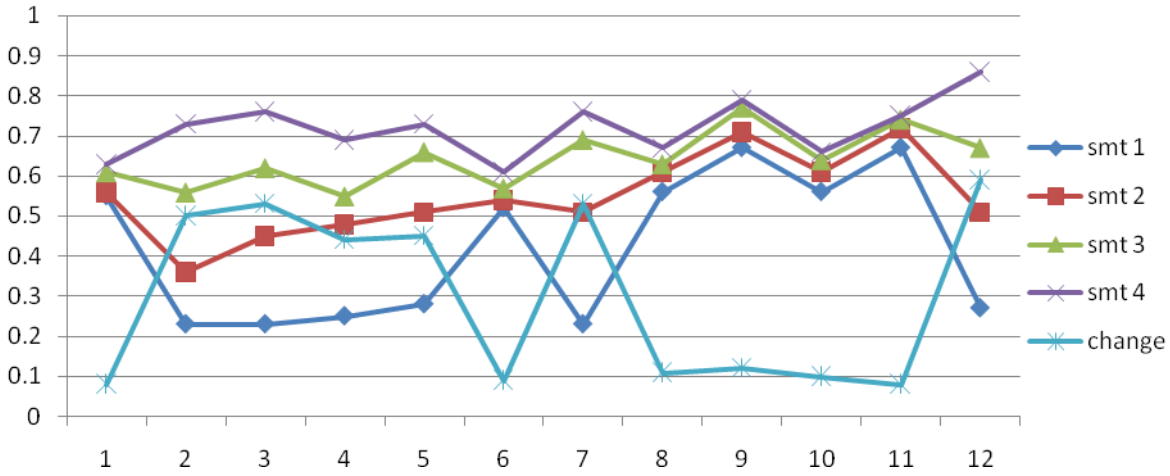

Figure 2. Development of the proportion of students' readiness to compete (12 indicators)

In the first semester of academic year 2013/2014, the students' readiness to compete was only dominant (indicated by more than 50% of students) to indicators of need for achievement, time management, self-efficacy, initiative, mastering information technology, and responsibility. Other indicators are still poor because it was shown less than 50% of students including: apply knowledge, critical thinking, problem solving, working collaboratively, creative thinking, and communication. In the second semester of academic year 2013/2014, more than 50% of students were able to show the behavior of need for achievement, working collaboratively, time management, creative thinking, self-efficacy, initiative, mastering of information technology, responsibility, and communication. Other indicators which students showed less strong are apply knowledge, critical thinking, and problem solving. In the 3rd semester and 4th semester of academic year 2014/2015, more than 50% of students were able to show 12 indicators including need for achievement, apply knowledge, critical thinking, problem solving, working collaboratively, time management, creative thinking, self-efficacy, initiative, mastering information technology, responsibility, and communication.

After implementing scientific approach based learning for four semesters, it was proved that scientific approach based learning is able to foster students' readiness to compete. There are five indicators increasing very strongly, the indicators are apply knowledge, critical thinking, problem solving, working collaboratively, creative thinking, and communication. The more intensive the students engaged with scientific approach based learning, the better students' skill to apply knowledge, critical thinking, problem solving, working collaboratively, creative thinking, and communication. This means that the implementation of scientific approach based learning can deliver students' readiness to compete. by scientific approach based learning, students will be able to apply knowledge, critical thinking, problem solving, working collaboratively, creative thinking, and communication.

Statistical analysis showed that the implementation of scientific approach based learning for 4 semesters impacted positively on improving the students' readiness to compete considered from the background of specialization and the gender of students (see Table 5).

Table 5. Average students' readiness to compete (score 1-5)

	Science class		Social Class		Gender		Total
	Male	Female	Male	Female	Male	Female	
1	3.03	3.20	3.30	3.53	3.10	3.31	3.20
2	3.94	4.03	4.07	4.20	3.98	4.08	4.03
3	4.08	4.13	4.23	4.20	4.12	4.16	4.13
4	4.32	4.46	4.30	4.33	4.32	4.42	4.36
Total	3.84	3.95	3.98	4.06	3.88	3.99	3.93
	3.94		4.03		3.93		

Source: Analysis of data compiled by researcher

After being engaged intensively in scientific-based learning, at the end of the first semester of academic year 2013/2014, the students' readiness to compete in the category of "moderate" (coefficient score of 3.20) and at the end of the second semester of academic year 2013/2014 increasing in the category of "ready" (coefficient score of 4.03). At the end of the third semester of academic year 2014/2015, the students' readiness to compete in the category of "ready" (coefficient score of 4.13), and at the end of the fourth semester of the academic year 2014/2015 the students tend to be "very ready" to compete (coefficient score of 4.36). Overall, after four semesters students engaged in scientific based learning, they have the readiness to compete in the category of almost "ready" (coefficient score of 3.93).

The result of analysis also showed that the longer and the more intensive the students engaged in scientific approach based learning, the higher the level of students' readiness to face the competition (See figure 1).

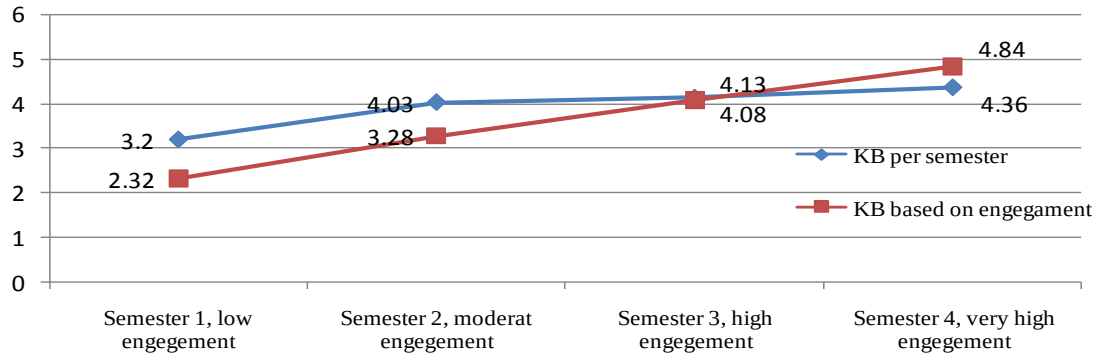

Figure 1 Graph of the development of students' readiness to compete (KB) per semester and KB based on the level of student engagement in learning activities

In other words, the more intensive the students engaged in scientific approach based learning, the more ready they face the competition. Figure 1 shows a graph of the development of students' readiness to compete per semester and based on the level of student engagement in learning activities.

The result of analysis showed, if at the end of the 1st semester of academic year 2013/2014 students' readiness to compete was at a score of 3.2, at the end of the fourth semester of the year 2014/2015 increasing to 4.36. The intensity of student engagement in learning also influences the students' readiness to compete. The students with the level of engagement in learning at the category of "poor" had readiness score of 2.32. The students with the level of engagement in learning at the category of "moderate" had readiness score of 3.28. The students with the level of engagement in learning at the category of "strong" had readiness score of 4.08. The students with the level of engagement in learning at the category of "very strong" had readiness score of 4.85. Student engagement in learning is the strongest and its influence towards the students' readiness to compete is the variable of engagement in learning.

The multiple comparisons test showed a significant difference in students' readiness to compete per semester and based on engagement in learning activities. Mean different with negative sign indicates the higher the students' readiness to compete, the more intensive students' engagement in learning activities approach based scientific (see table 6).

Table 6 Multiple comparisons of students' readiness to compete

Engagement in Learning		Mean different	Sig.	Semester		Mean different	Sig.
Poor	Moderate	-.7007	.000 *	Semester 1	semester 2	-.8316	.000 *
	Strong	-1674	.000 *		semester 3	-.9368	.000 *
	Very strong	-2459	.000 *		Semester 4	-1.1684	.000 *
Moderate	Strong	-.9735	.000 *	Semester 2	Semester 3	-.1053	.024 *
	Very strong	-1753	.000 *		Semester 4	-.3368	.000 *
Strong	Very strong	-.785	.000 *	Semester 3	Semester 4	-.2316	.000 *

*) Mean different is significant at the.05 level

Source: results of data analysis are summarized researcher

Based on the analysis of the Tests of Between Subjects Effects, it was known several variables that influence positively on the students' readiness to compete (Table 7).

Table 7. Tests of Between Subjects Effects

Source	Sum of quare	D f	Mean Square	F	Sig
Corrected models	159 198	45	3,538	34 593	.000 *
Gender	.753	1	.753	7363	.007 *
Involvement	41 727	3	13 909	136 005	.000 *
Specialisation * Gender	1,213	1	1,213	11 865	.001 *
Specialisation * Gender * involvement	1,609	3	.536	5246	.002 *

*) Significant α = .05

Dependent Variable: Readiness to compete

a. R Squared = .823 (Adjusted R Squared = .800)

b. Computed using alpha = .05

Source: The results of the data analysis are summarized by researcher

Based on the data from Table 7, it was known various variables that influence significantly toward students' readiness to compete were: gender of students, the level of student engagement in learning, interaction between students' specialization and gender, and the interaction between the specialization of students, gender, and student engagement in learning. Female students have the readiness to compete better than the male students. The contribution of several independent variables on the students' readiness to compete is at 80%.

VIII. Discussion

This study explained that the implementation of scientific approach based learning influence positively on the growth of students' learning activities. The implementation of scientific approach based learning activities has a strong impact on the growth of student learning. Student learning activities can be seen from the 11 indicators, there are engaged in activities, attention, observing, high order thinking, the courage of giving opinions, initiative to present, teamwork, proud of the tasks performed, originality opinions, oriented to the best work, and committed to the task. The results of this study supports the 1st hypothesis which states: "the implementation of scientific approach based learning can improve students' learning activities".

In the 1st semester, the first time a scientific approach based learning implemented; the average proportion of students' engagement in scientific approach based learning (including 11 indicators: observing, high order thinking, giving opinions, initiative to present, teamwork, originality opinions, oriented to the best work, and committed to the task) is at 38.8%. In the 2nd semester, the average proportion of students' engagement in scientific approach based learning is at 48.3%. In the 3rd semester, the average proportion of students' engagement in scientific approach based learning is at 60%. And at the end of the 4th semester, the average proportion of students' engagement in scientific approach based learning is at 71.3%. The average proportion of students' engagement in scientific approach based learning for all semesters is at 54.25%. The results of this study supports the 2nd hypothesis which states: "Scientific approach based learning can improve students' engagement in learning activities".

Various indicators of student learning activities increase significantly including observing, giving opinions, presentation, teamwork, and committed to the task. In other words, the implementation of scientific approach based learning which is implemented by using problem-based learning, project based learning, discovery learning, and the combination of the three can encourage the learning behavior of students to be more engaged in various learning activities, familiarize students to make observations, dare to express opinions, dare to present the results of the work, build the habit of working together, and strengthen the commitment of students on the task to be done.

The implementation of scientific approach based learning influence positively on the students' readiness to compete. It can be seen from the 12 indicators, there are need for achievement, apply knowledge, critical thinking, problem solving, working collaboratively, time management, creative thinking, self-efficacy, initiative, mastering information technology, responsibility, and communication.

In the 1st semester, the average proportion of students' readiness to compete is at 41.83%. The average proportion of students' readiness to compete in the 2nd semester is at 54.75%. The average proportion of students' readiness to compete in the 3rd semester is at 64.25%. The average proportion of students' readiness to compete in the 4th semester 4 is at 72%. The average proportion of students' readiness to compete for all semesters is at 58.21%. Various indicators of students' readiness to compete increase significantly including apply knowledge (50%), critical thinking (53%), problem solving (44%), working collaboratively (45%), creative thinking (53%), and communication (59 %). The results of this study supports the 3rd hypothesis which states: "the more intensive the students engaged in scientific approach based learning, the stronger the students' skill to compete".

IX. Conclusion

The scientific approach based learning can be applied by teachers by using problem based learning, project based learning, discovery learning, and the combination of the three. This study showed that the implementation of scientific approach based learning influences positively on the students' skill to compete mainly based on six indicators, they are: apply knowledge, critical thinking, problem solving, working collaboratively, creative thinking, and communication. The study also explained that there is the different significant in students' readiness to compete based on: (a) the intensity of student engagement in learning activities, and (b) based on students learning activities per semester. The more intensive the students engaged in learning scientific approach, the higher their skill to compete. In other words, the implementation of scientific approach based learning can be used as an instrument to improve the students' skill to compete. This study supports previous studies (Piirto, 2011; Jackson, 2010; Jackson, 2013; Council of Chief State School Officers, 2011) which states that readiness to compete in the 21st century will be determined by the skill to apply knowledge, critical thinking, problem solving, teamwork, creative thinking, and communication. Thus educators are expected to apply scientific approach based learning in deeply to encourage the growth of students' skills to compete.

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