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Exploring a Direct Relationship between Students' Problem-Solving Abilities and Academic Achievement: A STEM Education at a Coffee Plantation Area

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ABSTRACT

Factors affecting the quality of education can be observed from students' problem-solving abilities and academic learning achievements. This research aims to examine a direct relationship between students' problem-solving abilities and academic learning achievement by using a science, technology, engineering, and mathematics (STEM) education at a coffee plantation area in Indonesia. In analyzing data, students' problem-solving abilities and academic learning achievements were exposed to quantitative descriptive of correlation bivariate rank Spearman. This study consisted of 148 junior-high-school students in a coffee plantation area. The results indicated that there was a positive correlation between the students' problem-solving abilities and academic learning achievements in favor of STEM education. This means that the more problem-solving skills the students have, the better academic learning achievement they perform. These positive results recommend that the integrated STEM education, as an approach, should be included varied contexts, especially in the Asian region. Moreover, science teachers should hone students' problem-solving skills via a mixed way, e.g., the integrated STEM education. In addition, STEM education will be helpful for students (who especially work and live in plantation areas) to understand the role of science in their everyday lives.

Keywords: Academic learning achievement, coffee plantation, problem-solving ability, STEM education.

INTRODUCTION

Education is an attitudinal change process through individual learning procedure. In addition, education mainly proposes to make students well-educated citizens, who are able to compete on a global level (Angier, 2010). Thereby, education is a vital factor in creating qualified human resources. In other words, the quality of education affects the quality of

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graduate. Aslam, Adefila, and Bagiya (2018) state that one alternative way to improve the quality of education is to apply STEM education, which integrates science, technology, engineering and mathematics (Herschbach, 2011).

Integrated STEM Education, as an appropriate learning approach, is projected into the future. STEM education, which integrates more than two disciplines, prepares students to face the competition and the development of the times (Gulen & Yaman, 2019). Moreover, Fadel (2008) and Hofstein and Lunetta (2004) state that students should possess the 21st century skills, such as good academic ability, problem-solving ability, collaboration, innovation, and creativity. It is believed that a STEM education has a potential to help students gain these abilities. Issabelle and Zenn (2017) explain that some STEM activities through the Science Tasks Enhanced Process Skills (STEPS) can initiate problem-solving abilities and innovations, as well as enhancing academic learning achievements.

Factors that affect the quality of education can be observed from students' problem-solving abilities and academic learning achievements. In view of Mayer (2014), tests measure student learning, e.g., retention (i.e., remembering the presented information) and transfer (i.e., applying the information to novel problems). Information means a problem-solving ability, which is necessary for both learning and testing. Problem-solving abilities have been the most extensively studied transversal skills over the last decade (Bahar & Aksut 2020; Gupta, Pasrija, and Kavita, 2015). These abilities have been investigated in the most prominent comprehensive large-scale international assessments (OECD, 2014). Meanwhile, academic learning achievements are utilized as data to determine teacher professionalism related to work commitment (Gasse, Valonmel, & Petegem, 2016). This means that teacher's instructional performance holds a significant role in student's academic learning achievement. A measure should handle students' ways of thinking that covers knowledge, understanding, skill or ability (Saroyan & Trigwell, 2015). Skill and knowledge relatively construct adequate achievements. Proper academic learning achievements have variations along with several factors that are associated with learning. According to Baseya and Francis (2011), factors affecting student learning and achievement include motivation, abilities, attitudes towards learning and a particular subject, and self-concept.

Few studies have rigorously explored the relationship(s) between students' problem-solving abilities and academic learning achievements via a STEM education. Han, Rosli, Capraro, and Capraro (2016) suggest that STEM activities could enhance students' problem-solving abilities as well as mathematical academic learning achievement. However, Sarican and Akgunduz (2018) offer that although STEM education does not significantly increase students' problem solving, it highly contributes to academic achievement. Therefore, more evidence is needed to give a better insight about this relationship. Likewise, none of studies on general STEM education has specifically focused on particular remote locations such as the coffee plantation area.

Therefore, exploring in-depth relationship(s) between problem-solving abilities and academic learning achievement is essential for feasibility and effectiveness of an integrated STEM Education. Hence, teachers may become more focused and aware of their instructional designs in terms of students' problem-solving abilities and good academic learning achievements. In addition, teachers may become more creative in especially designing STEM education to hone students' high thinking levels. Finally, conducting this current study would provide significant insights into STEM education.

The Context of the Study

Jember Indonesia mostly composes of plantation areas. Two famous plantation products in Jember are coffee and tobacco. Coffee is a global product, which has considerable economic value. Thus, it supports a good living for people worldwide. Indonesia is one of the biggest coffee manufacturers following Brazil, Vietnam, and Columbia. Coffee, which is a natural source, obtains favorable prosperity in Jember. That is, Perusahaan Daerah Perkebunan (a government office of plantation) of Jember manages 4.278,2239 Ha field for plantation and non-plantation (Suratno & Dian, 2017).

The aforementioned geographical conditions inevitably affect all daily life and societal activities. For example, these conditions mostly affect education. In everyday life, students actively support their family incomes/economic budget by helping their parents' works after the school (Suratno & Dian, 2017). Most of these students' parents are farmers and hired laborers in coffee plantations. Thus, the coffee plantation area becomes their learning, playing and growing up places. Moreover, Parmin and Sajidan (2019), who studied about the uniqueness of a particular place, namely industrial school areas, revealed that the schools around industrial areas formed a unique community system. Indeed, children in industrial areas sociologically need a different way of science learning.

Integrated STEM Education

Moore et al. (2014) define integrated STEM education as an effort to combine some or all of four disciplines (i.e., science, technology, engineering, and mathematics) into one class, unit, or lesson that is based on connections between the subjects and real-world problems. However, Sanders (2009) describes integrated STEM education as approach to explore teaching and learning between any two or more of STEM disciplines or between a STEM subject and other school subjects. Both authors argue that STEM, as an integrated approach, embraces more than two disciplines or fields in the real-world problem contexts.

In order to compete with the global economic system in the 21st century, a country needs an established education that enables students to get an understanding of Science, Technology, Engineering and Mathematics (STEM) (Akgunduz, 2016). Furthermore, science and technology education have recently aimed at the interdisciplinary integration, such as the effective use of technology (engineering) and problem-solving abilities (mathematics) in building STEM education. The development of STEM education in the developed countries shows that STEM needs to be existed in the Indonesian educational system. For instance, Wahono and Chang (2019a) showed that the development of STEM education in Indonesia fell into an initial position (four positions of STEM education: not yet ready, initiating, improving, and expanding). It is believed that creating an interdisciplinary learning results in better achievement levels for science, mathematics, engineering, and technology (Milaturrahmah, Mardiyana, and Pramudya, 2017).

Problem-Solving Skills

One of the factors affecting science learning is problem-solving skills. Tok, Tok, and Dolapçıoğlu (2014) argue that problem-solving strategy includes both a thinking method and performing an activity. Problem-solving strategy is associated with obtaining conceptual understanding, defining problems and examining possible solutions (Bahar & Aksut, 2020). Problem-solving also relates to a higher-order thinking level that requires logical answers. Thereby, problem-solving strategy can be considered as a factor affecting achievements and conceptual understanding. Also, experience, as a factor, influences problem-solving skills (Tok, Tok, & Dolapçıoğlu, 2014). In brief, we should notice that problem-based learning interacts prior knowledge with a proper decision or decision-making procedure (Hooker, 2017; Mefoh, Nwoke, Chukwuorji, & Chijioke, 2017).

According to Supapidhayakul (2011), knowledge and abilities-related learning activities definitely require to obtain social/community life and improve its global complexity and competition. Learning activities include students' developmental requirements (Kleebbua & Siriparp, 2016). Problem-solving strategy mostly utilizes several steps, e.g., understanding a problem, making a plan, carrying out a plan and revising/reviewing the completed solution (Polya, 1973). Molnár and Csapó (2018), who examined the role of exploration strategies in the first phase of problem-solving strategy, shed new light on and provided a new interpretation of previous problem-solving strategies. They also highlighted the importance of problem-solving skills and problem-solving strategies as a tool for acquiring knowledge within new contexts during and beyond school lessons. Even though some researches have discussed problem-solving strategy, little research has concentrated on exploring the relationship between problem solving skills and academic learning achievement by using STEM education.

Academic Learning Achievement toward STEM Education

STEM education, which integrates four different disciplines (Science, Technology, Engineering and Mathematics), support concept learning and conceptual understanding. STEM education is frequently known as a meta-discipline used in problem solving strategy (Breiner, Harkness, Johnson, & Koehler, 2012). Therefore, academic learning achievement is very closely associated with STEM education. Olivarez (2012) proved that the STEM group performed better at all measured learning outcomes than did non-STEM group. The results showed that the STEM education with Project-Based Learning (PBL), collaborative learning, and hands-on strategies positively impacted eighth-grade students' academic learning achievement in mathematics, science, and reading.

Pertaining to academic learning achievements in Math-science courses, previous research classified the majority of students (80%) studying at a coffee plantation as apprentice level, whereas the categories 'practicing, and beginners' were 16% and 4% respectively. The students in the 'apprentice' level were able to: (a) obtain a proper strategy to determine coffee rod locking, and design a coffee plantation effectively, (b) present logical reasons and verification processes within considering coffee design steps and coffee rod inoculation, and (c) draw inoculation steps of a coffee rod and design coffee plantations based on society's rules (Suratno & Dian, 2017). These students also grasped experiences upon techniques (a part of STEM) and design of an appropriate plan of the coffee plantation area. Hence, STEM education delivers learning benefits towards students, since students are able to explore their creativities to solve a problem through some disciplines. However, few researches have studied about how the STEM education in the special context of a plantation area is related to students' achievement levels.

Theoretical Relationship between Problem-solving skills and Academic Learning Achievements

Problem-solving skills have a fundamental role at constructing concepts and achieving academic learning. Gupta, Pasrija, and Kavita (2015) found that problem-solving skills had a significant effect on high-school students' academic achievement levels. Saroyan and Tigwell (2015) reported that a student with proper problem-solving skills automatically proposed a suitable creative thinking and practicing (as part of cognitive learning system) that would affect his/her academic learning achievement. Moreover, Mustafić, Niepel and Greiff's (2017) claimed that a student, who proposed a high self-concept towards problem-solving strategy, showed an excellent performance for the relevant scientific subject. Therefore, we assume that potential positive relationships between students' problem-solving skills and academic learning achievements may be found for an integrated STEM education. Indeed, a measure should train students' ways of thinking that covers knowledge, understanding and problem-solving skills (Saroyan & Trigwell, 2015).

Problem-solving strategy is essential for project-based learning processes and hands-on activities. In view of Chiang and Lee (2016), because students need to overcome all difficulties at completing a project, their problem solving skills gradually get better and become meaningful. Thus, STEM education empowers problem-solving skills and academic learning achievements due to its characteristics. For example, Han, Rosli, Capraro, and Capraro (2016) said that the integration of project-based learning into STEM activities engaged students with problem-solving skills in real-world and improved their overall scores of mathematics. Meanwhile, Sarican and Akgunduz (2018) addressed that STEM education did not significantly increase students' success levels and reflective thinking skills towards problem-solving strategy but provided a positive contribution to their academic achievement levels. Therefore, a rigorous STEM study is needed to grasp more evidence on the relationship(s) between problem-solving skills and academic learning achievements.

Research Questions

Two research questions guided the current study:

1. How does the STEM education at the coffee plantation area affect the students' problem-solving skills and academic learning achievements?
2. Is there any correlation between students' problem-solving skills and academic learning achievements after the STEM education at the coffee plantation area?

METHODS

a) Design and Procedure

Through an associative research design, this study purposed to determine the relationship(s) between variables. Indeed, a variables correlation is an interactive associative relation, which is the relation of problem-solving abilities and academic learning achievements on the natural science subject. Location was purposefully selected. The current study utilized tests and observations as data collection techniques. To explore students' problem-solving skills a questionnaire with four open-ended questions were used. Each open-ended question represented four indicators (e.g., *understanding the problem, making a plan, carrying out the plan, and revising the completed plan*). Prior to responding the questionnaire, the students were asked to read and understand the problem regarding societal issues. The researchers provided a sample problem as follows:

> "Coffee (Coffea spp) is an export commodity that provides a high amount of foreign exchange, especially from plantation commodities involving several producing countries and consumer countries. Coffee plays an important role in international trade in the form of coffee beans, instant coffee, or other forms. Coffee plants in Jember are mostly cultivated in the form of smallholder plantations with limited cultivation technology. Coffee processing is the most important activity in determining the quality of the coffee. Mistakes in the processing will be directly related to the quality of the coffee. One process of the coffee processing is drying. The drying process at the farm level, especially coffee farmers in Jember, in general, cover direct sun drying, which is conducted on the ground or a dirty lining in the open place such as yard or roadside. In this way, the possibility of microbial contamination through dust, air, animals and other impurities is high. "
>
> 1) Analyze any existing problem in the scenario!
> 2) Depict your ideas to solve the problem(s)!
> 3) Apply your ideas to solve the problem comprehensively!
> 4) Double-check your results, adjust your problems and contexts. If necessary, please use the STEM principles for your answers.

Observations were directly performed to get more information about the students' problem-solving skills. Meanwhile, academic learning achievement was measured using a test instrument developed by the researchers. A four-item test had a formative scaffold, which was designed to give assignment-related feedbacks (Kent, Laslo, & Rafaeli, 2016). The test referred to the high-level thinking indicators, that are the third level and fourth level cognitive of the Bloom's taxonomy. Hence, it required the students to provide a logical answer in completing the problem within several disciplines (science, technology, engineering, and mathematics).

Before collecting the data, the teaching intervention was carried out using a STEM education-based lesson plan (integrated STEM education). Two experts validated the lesson plan. Then, one of the authors, who possessed a four-year teaching experience, directly implemented the teaching intervention. Furthermore, each class experienced a four-week instructional period for several different science topics such as energy. In each class, the teacher taught science topics using several technological media such as laptops, Power point presentation, and mobile phones. Students could access various learning resources through their mobile phones, even though the internet connection was terrible. In addition, the teacher trained the students to use some low-cost materials to design and make any models such as coffee dryer designs or models that converted electricity into heat energy.

b) Participants

This study took place in junior high schools at the coffee plantation area in Jember, Indonesia. Four class groups involved a total of 148 students from four different schools. The students came from low and middle socio-economic status families. Table 1 presents their demographic data.

Table 1. *An overview of the students' demographic data*

Schools	Gender	Ethnicity (%)	Parents' Occupations (%)
School 1	14 Male; 24 Females	73.68 Madurese; 23.68 Javanese; 2.64 Others	10.52 Landlord; 68.42 Farm worker; 10.53 Civil servants; 7.9 Traders; 2.63 Others
School 2	17 Male; 21 Females	81.57 Madurese; 13.13 Javanese; 5.3 Others	38.0 Landlord; 52.63 Farm worker; 7. 89 Civil servants; 7.89 Traders; 6.41 Others
School 3	16 Male; 21 Females	78.4 Madurese; 18.9 Javanese; 2.7 Others	18.92 Landlord; 56.75 Farm worker; 5.40 Civil servants; 5.40 Traders; 13.53 Others
School 4	16 Male; 19 Females	62.85 Madurese; 31.43 Javanese; 5.72 Others	14.28 Landlord; 51.43 Farm worker; 17.15 Civil servants; 8.57 Traders; 8.57 Others

c) Data Analysis

Determining variable correlations needs the results of each assessment. Assessments of Problem solving skills and academic learning achievements were converted to 1-100 points. Then, score was calculated by a subsequent formula:

$$Score = \frac{obtained\ score}{total\ score} \times 100$$

The assessment of problem-solving skills covered the following criteria adopted from Shute and Wang (2015): (0-20) strongly inappropriate, (21-40) less appropriate, (41-60) neither appropriate nor inappropriate, (61-80) appropriate, and (81-100) strongly appropriate. Data were analyzed via quantitative descriptive of correlation bivariate rank Spearman using SPSS^{TM} 24.0. Correlation was examined to elicit the relationships between variables (see Figure 1).

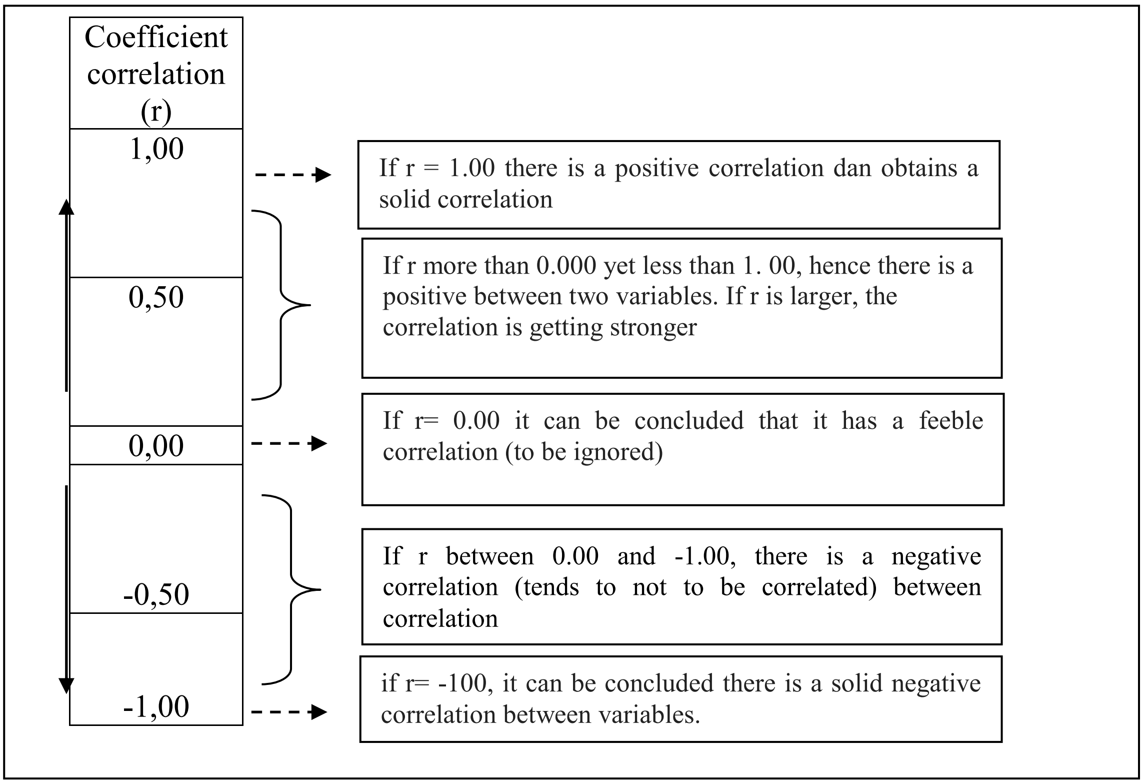

Figure 1. An interpretation chart for correlation intensity (Higgins, 2005)

FINDINGS

In order to discover the correlation between the effects of the integrated STEM education on problem-solving skills and academic learning achievement, variables with several indicators were analyzed. Mean scores of the students' problem-solving skills are displayed in Table 2.

Table 2. *Mean scores of the students' problem-solving skills*

Indicators	Mean score ± Standard Deviation	Categories
Understanding the problem	61 ± 5,62	Appropriate
Making a plan	68 ± 5,62	Appropriate
Carrying out the plan	65 ± 5,62	Appropriate
Revising the completed plan	55 ± 5,62	neither appropriate nor inappropriate

All indicators showed good results for the students' problem-solving skills and fell into the 'appropriate' category. However, the indicator '*revising the completed plan'* was classified under the 'neither appropriate nor inappropriate' category. This means that the STEM education did not really inspire a good influence for this indicator. In fact, each indicator is related to another one. The '*making the plan'* indicator may be influenced by the previous one (*understanding the problem)*. That is, the better students *understand the problem,* the better they *make the plan* for solving the problem. Despite the fact that the last indicator (revising the completed plan) was the peak of problem-solving indicators in this study, the mean score of this indicator fell into the category 'neither appropriate nor inappropriate.' On the other side, Table 3 presents mean scores of academic learning achievements after the integrated STEM education at a coffee plantation area.

Table 3. *A Summary of academic learning achievements*

Item Number	Cognitive Levels	Mean Score	Adjusted Mean Score	Categories
1	C3	18,75	87,50	strongly appropriate
2	C4	22,18	88,75	strongly appropriate
3	C4	17,83	89,16	strongly appropriate
4	C4	31,85	70,78	appropriate

Note: C represents cognitive level referring to Bloom's taxonomy (Krathwohl, 2002)

In order to determine the categories, mean scores were converted to 1-100 scale (Shute and Wang, 2015). Table 3 shows that all academic learning achievements had good categories. This means that the integrated STEM education had a good influence on improving the students' academic learning achievements since all categories indicated the 'appropriate and strongly appropriate' categories. Further, this study used items at third and fourth cognitive level. This means that the question would explore about the students' higher-order thinking skills (HOTS). This research denoted that the integrated STEM education had a good impact in developing the students' critical-thinking and problem-solving skills. Thus, the possible relationship between academic learning achievement and problem-solving skills might be very close. Therefore, the researchers conducted a follow-up analysis to prove the hypothesis.

Through a Pearson-Moment correlation test, this research examined the correlation values between the students' problem-solving skills and academic learning achievement after the treatment with the integrated STEM education at the coffee plantation area in Jember, Indonesia. Table 4 displays statistical results of Pearson-Moment correlation test.

Table 4. *Correlation values between the variables*

Correlations			
		Problem Solving Ability	Academic learning achievements
Problem Solving Ability	Pearson Correlation	1	.312*
	Sig. (2-tailed)		.31
	N	48	48
Academic learning achievements	Pearson Correlation	.312*	1
	Sig. (2-tailed)	.31	
	N	48	48

**. Correlation is significant at the 0.05 level (2-tailed).*

As seen from Table 4, the correlation was found to be .312. Given Higgins' (2005) interpretation of correlation intensity, this value (.312) indicates a positive correlation between two variables. That is, if scores of problem-solving skills increase, scores of academic learning achievements increase as well. Further, this correlation co-efficient (.312) has verified a significant correlation between the effects of the integrated STEM education on the students' problem-solving skills and science learning achievements.

DISCUSSION

The results revealed that mean scores of the students' problem-solving skills were categorized under the category 'appropriate' for three indicators (*understanding the problem, making a plan, and carrying out the plan)*. However, the indicator (*revising the completed plan)* was classified under the category 'neither appropriate nor inappropriate.' Such a different category may result from a lack of the students' attentiveness towards their used answers.

Open-ended questions in problem-solving strategy allow students to think more freely while engaging knowledge (Bennett, 2011). Such a filexibilty of an open-ended question may result in different levels by depending on the aim of the evaluation. For the current case, Questions in the academic learning achievement, which required analytical answers, proposed to foster the students to apply a high level of thinking. According to Sajadi (2013), open-ended questions are an essential part of problem-solving, which combines real-life problem(s) with applications. Thus, selecting open-ended question was suitable for this study to determine what had been learned and measured.

Questions in the academic learning achievement, which assessed problem-solving skills, composed of four items with various cognitive levels, called higher-order thinking skills (HOTS). HOTS includes students' thinking of upper ranked levels (Levels 3-6) of Bloom's taxonomy. The first item in the academic learning achievement engaged cognitive level 3 (C3) (e.g., application). This level includes the ability to utilize and apply the obtained knowledge. The second item in the academic learning achievement embraced cognitive level 4 (C4) (e.g., analysis). In this level, students are able to identify and analyze by determining the pattern, and the constructed ideas. Those cognitive determinants were based on Krwathwohl's (2002) statement that indicators of high-level thinking in problem-solving strategy are to analyze, evaluate, and create. Wahono, Rosalina, Utomo, and Narulita (2018) assert that STEM-based engineering design promotes critical thinking and intellectual traits, which are important components for stimulating science and especially fostering HOTS.

The results indicated that the integrated STEM education related problem-solving skills to academic learning achievement. In this sense, a STEM education supports students' creativity by integrating four different disciplines to solve any problem (Moore et al., 2014; Wahono & Chang, 2019b). A student, who possesses proper problem-solving skills, automatically proposes a suitable or appropriate creative thinking. Also, (s)he is able to make cognitive-related practices, which affect his/her academic learning achievements (Saroyan & Tigwell, 2015). The results of the Pearson-Moment correlation indicated a positive correlation (.312).

Even though the correlation coefficient was relatively weak, it was positive. This means that the correlation value between the students' problem-solving skills and academic learning achievements was in line. Nevertheless, some of the students in the coffee plantation area seem to have showed negative correlation values. Indeed, this issue is slightly coherent with the debates depicted by Han et al. (2016) and Sarican and Akgunduz (2018). That is, the relationship(s) between the effects of STEM activities on students' problem-solving skills and academic achievement levels may have a strong correlation. Moreover, some potential factors may influence the results of a weak positive correlation. This argument is of interest in future researches.

In a nutshell, the results showed that the better problem-solving skills students have the better academic learning achievement levels they possess. This result is consistent with that of Mustafić, Niepel, and Greiff (2017). That is, if a student proposes a high level of self-concept towards problem-solving strategy, (s)he indicates the excellent performance of any science subject. Because problem-solving strategy involves students' cognitive skills, it can be concluded that the problem solving strategy is identical to thinking. Meanwhile, student thinking (cognitive) is related to the obtained academic learning achievements, and in this case, the academic learning achievement is also strongly pertaining to the STEM education approach that was used in this study. Isabelle and Zenn (2017), who introduced a practical instruction (called *STEPS to STEM via* an inquiry-based science curriculum), focused on the development of students' science process skills and problem-solving skills. The *STEPS to STEM* will provide students with valuable and essential experiences in science.

CONCLUSION and IMPLICATIONS

In light of the results, this study pointed to a significant positive correlation between the students' problem-solving skills and academic learning achievements via the integrated STEM education in the coffee plantation area. It can be deduced that the better problem-solving skills students have, the better academic learning achievement they perform. These fruitful results have some implications for the effectiveness of the STEM education, especially for the Asian region. Finally, this current study provided significant insights into the STEM education.

Even though the researchers attempted to describe the relationship(s) between the effects of the integrated STEM education on students' problem-solving skills and academic learning achievement, analyzing each STEM activity for problem-solving skills did not sufficiently elicit in-depth information. This study suggests that science teachers should hone their students' problem-solving skills in a mixed ways. The implementation of the STEM education is one of the alternatives to achieve this beneficial mixture. Therefore, as illustrated in the Next Generation Science Standards (NGSS) (Lead States, 2013), students not only need to have a sound understanding of the big ideas in science and good academic learning achievement, but also act as critical thinkers and problem solvers prior to the secondary school years. In addition, the integrated STEM education will be beneficial for students (especially for working and living in plantation areas) to solve their everyday life problems.

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APPENDICES

A) A Sample Item from the Academic Achievement Test
1) Articulate the role of green energy resources in the modern technology era! (C3)
2) Estimate any possible heat energy resources that could be used in our daily lives? (C4)

B) A Sample Lesson Plan

Lesson Plan

School : School 1
Grade : Seventh
Subject /topic : Science/ energy
Duration : 6 x 35 minutes

A. Learning Objective
By engaging a real-world problem about energy, students are able to in-depth understand concerning energy resources as well as hone their problem-solving skills.

B. Learning Steps
1) Students listen to the teacher, who talks about the introduction and learning objective.
2) Students listen and get attention to the subject matter concept (energy and its forms) taught by the teacher
3) Students create their small groups and discuss the real-world problem given by the teacher
4) Students do minds and hands-on activities, which deal with the problem. They challenge a socio-scientific issue (i.e., coffee drying processing at the coffee plantation area).
5) Students analyze and transform their results into the form of either narration or simple graphics.
6) Students do a presentation concerning their results in front of the class.
7) Students and the teacher review, revise and evaluate the whole learning processes.

C. Learning Assessments
Formative assessments:
1) Problem-solving skills through the open-ended questions and observations
2) Academic learning achievements through the test

$$Score = \frac{obtained\ score}{total\ score} \times 100$$

D. Learning Media
1) Laptops, Power point for presentation, and smart phones.
2) Some low-cost materials such as small electric fun, cardboard, cutter knife, scissors, marker, ruler, etc.

E. Learning Resources
1) BSE book of the seventh grade (a free science book provided by the Indonesian government)
2) Internet