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The Role of Mentoring to Win Science Project Competition in Indonesia

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ABSTRACT

The role of mentors to advice students on their science projects is seldom being discussed in the current STEM literature. Science project competition is a platform for students to expose their scientific work. In completing their science project, schools provide them with mentors. However, there were challenges detected regarding the implementation of the mentoring process in the science project competition in Indonesia. Hence, the purpose of the study was to examine the role of mentoring to win science project competition in Indonesia. Based on Lane model, several sub-constructs such as supervision, relationship, coaching, communication, and role model were used to measure the main construct – mentoring. A survey design was used to collect the empirical data. A sample of 250 participants was selected using a stratified random sampling from 10 science competition sites (N = 700) in Indonesia in 2017. The instruments in this study were a set of questionnaires, open-ended items, and semi-structured interview protocol. Quantitative data were collected from the respondents using a set of questionnaires and qualitative data were collected from the selected participants by interview. The validity of the questionnaires was verified by five experts in the field. The reliability of the questionnaire was tested using Cronbach Alpha and found to be $\alpha = 0.99$ which showed a high internal consistency of the instrument. The quantitative data was analyzed using descriptive and inferential statistics such as frequency, percentage, mean (M), standard deviation (SD), t-test, ANOVA, Pearson correlation and regression analysis. The qualitative data were analyzed using thematic analysis. The questionnaires were distributed to the selected respondents during their participation in science project competitions in 2017 and the jury scores in the competitions were used as a measure for their achievement. The empirical data from the questionnaire showed that the most rated mentoring skill by the students was supervision, followed by coaching, role-model, and communication. Whereas the lowest mean in mentoring is research skills. The findings from the open-ended items showed several positive behaviors of the mentors were expected to reduce the students' stress such as being fun, cheerful, having sense of humor, smiling, sociable, never made fun of the students, and giving hope. In the interview session, the students added patience as a key positive behavior of the mentors. Regression analysis found that the most influencing factors of mentoring were communication and coaching. In conclusion, a new mentoring framework based on the empirical data in this study could be developed. This framework could be used by teachers and students in schools that will participate in future science project competition.

Keywords: Mentoring, science project competition, secondary school students, survey design, Indonesia

INTRODUCTION

Science project competition is a platform for students to present their research projects. The main goal of the science competition is to provide opportunity for the students to construct new knowledge, to innovate, and to increase their interest in science through scientific inquiry and scientific methods

(Abernathy & Vineyard, 2001). The difference between science olympiad and science project competition can be seen from the concept of the competition. In the science olympiad, the students compete individually or dyadically to solve a given problem while in science fair the students work in a team according to a proposed challenge or problem (Abernathy & Vineyard, 2001; Dionne et al., 2012). In science fair, the students conduct a science project in a given subject area by using research and scientific skills to solve a real problem. The output of the science fair can be in the form of a new knowledge, a model or a product. Also, in science project competition or science fair, the participants are expected to expose the results of their research in the scientific poster exhibition and to present their research orally to the panel of judges (Tortop, 2013). However, there were limited studies related to the students' achievement in science project competition (Czerniak, 1996; Longo, 2012).

Directorate General of Secondary Education of Indonesia (2014) reported that Indonesia is training its youngsters to be creative, innovative, and entrepreneurial. Moreover, Hendayana, Supriatna, and Imansyah (2010) reported that Indonesia is rigorously sending its youngsters to compete in science competitions locally and internationally. Nevertheless, Permanasari (2010) mentioned that science project in the form of research is not a common practice in secondary schools in Indonesia, it is being practiced separately as laboratory activities. Small numbers of school in Indonesia, which are mostly international schools, have included research in their curriculum. In public school system, students experience conventional style of learning, which is more teacher-centered as reported by Bahri (2014). Students who have interest in doing research are expected to join out of school activities or to choose science club as extra curriculum activity. The National Curriculum 2013 with an encouragement on more creativity in learning has been failed in the first year of implementation and has been withdrawn by the government. Teachers were not prepared for a student-centered and active learning environment. Hassan et al. (2017) stated in their report that teachers need guidance on higher-order thinking skills in teaching.

There is a need to establish mentoring system to nurture young scientists (Clynes et al., 2019). According to Bozeman and Feeney (2007), mentoring is a symbiosis relationship whereby a senior or more experienced person (the mentor) provides psychosocial support, career guidance, role modelling, and coaching to a junior person - the protégé. In this study, mentoring comprised six elements: supervision, relationship, coaching, communication, role model (Lane, 2004), and research skill (Creswell, 2008). In the context of mentoring in science project, however, most science teachers were not properly trained as a mentor or as a coach. Despite the key finding from the literature that good mentoring could enhance students' achievement in science project competition, several empirical studies for example, Pidcock et al. (2000), Jackson (2003), Bogat and Redner (1985), and Presbury et al. (2005) have reported poor preparation of students to enter science competitions due to poor mentoring and coaching.

THEORETICAL FRAMEWORK

Mentoring as a main construct in this study was selected due to its importance in science project competition. Kram (cited in Bozeman & Feeney, 2007) theorized mentoring as a symbiosis relationship whereby a senior or more experienced person (the mentor) provides psychosocial support, career guidance, role modelling, and coaching to a junior person (the protégé). The specific sub-constructs of mentoring are taken from Lane (2004) – which consist of relationship, supervision, communication, role model, and coaching. The last sub-construct of mentoring is research skill which is critical in mentoring science project according to Creswell (2008). The first sub-construct of mentoring is relationship, which conceptualized by Byington (2010) as a process of building trust, defining roles and responsibilities, establishing short and long-term goals and collaborating efforts to solve problems.

The second sub-construct is supervision which is theorized by Cooper and Forrest (2009) as the facilitation process to provide supportive opportunity and conducive environment to guide and nurture supervisees to grow and achieve their potential. Next, communication is also a critical element in mentoring. According to Keyton (2011), communication is a two-way process to exchange thoughts, ideas, and emotions and to convey and discuss meaning or to provide feedback by using oral, written or gesture to achieve common understanding. Related to communication is a role model which is pertinent in mentoring. Role model is a respected person who could be emulated by others especially

by younger generation. Zwilling (2010) hypothesized the traits of a good role model which include confidence, leadership, effective communication, knowledgeable, empathy and being helpful.

The fifth sub-construct of mentoring is coaching which could be defined as a form of development in which an expert or an experienced person train a learner or a client to achieve a specific personal or professional goal by providing training or guidance. Canfield and Chee (2013) theorized that coaching is a process of nurturing a person by using critical strategies such as effective listening, asking relevant questions, using feedback, providing demonstration, and providing encouragement and support. Finally, the sixth sub-construct of mentoring is research skills which is critical in science competition. Creswell (2008) defined research skills as an individual ability to collect and analyze data or information in order to answer research questions and ultimately to enhance his or her understanding of the subject under study.

METHODOLOGY

The aim of the study was to examine the role of mentoring to win science project competition in Indonesia. The objectives of this study were (a) to identify the role of mentors in science project competition as perceived by the respondents, and (b) to determine the factors that influence effective mentoring in the context of science project competition. The respondents in this study were secondary school students in Indonesia who participated in science project competitions. There were ten sites of science project competitions which hosted by a non-government organization in Indonesia, namely the Center for Young Scientists. The competitions were run in sequences between August 2017 and November 2017 in ten different places in Indonesia as an annual program of the center. The criteria of the competitions were the same and the standard of the competitions were assured. The ten science project competitions run in North Sumatera province, South Sumatera province, West Java province, Central Java province, East Java province, Bali province, Central Kalimantan province, Special Region of Jakarta, Special Region of Yogyakarta, and Surabaya City. The student population size who participated in the competition was 700. Using the Krejcie and Morgan (1970) formulation, the sample size was 250. The sample size of each of the student strata or sub-population was determined from the proportion of the sub-population. Next, a stratified random sampling was conducted to select the student sample in each of the sub-population.

The instruments in this study were a set of questionnaires, open-ended items, and semi-structured interview protocol. Quantitative data were collected from the respondents using a set of questionnaires and qualitative data were collected from the selected participants by interview. The validity of the questionnaires was verified by five experts in the field. The reliability of the questionnaire was tested using Cronbach Alpha and found to be $\alpha = 0.99$ which showed a high internal consistency of the instrument. The quantitative data was analyzed using descriptive and inferential statistics such as frequency, percentage, mean (M), standard deviation (SD), t-test, ANOVA, Pearson correlation and regression analysis. The questionnaires were distributed to the respondents during their participation in science project competitions in 2017 and the jury scores in the competitions were used as a measure for their achievement.

The structure of the questionnaire was illustrated in Table 1. Part A of the questionnaire was the demographic information of the respondents such as gender, school level, school type, age groups, and their achievement in science project competitions. Part B comprised of seven items on relationship, nine items on supervision, ten items on communication, nine items on role model, four items on research skills, and eight items on. Part C of the questionnaire consisted of three open-ended items on mentoring in general regarding students' participation in science project competitions. The interview protocols comprised of three questions regarding mentoring on science project competition.

Table 1. The structure of the questionnaire

Items	Description	Constructs
Part A	Background information of the respondents	Demographic data
Part B		
1 - 6	Relationship between the respondents and their mentor	Relationship
7 - 15	Supervision on science project by the mentors	Supervision
16 - 25	Communication between the students and the mentors	Communication
26 - 34	Role model on mentor	Role Model
35 - 38	Research skills of the mentors	Research Skills
39 - 46	Coaching regarding science project competition	Coaching
Part C	Open-ended questions on mentoring	Mentoring

FINDINGS AND DISCUSSION

The findings of this study were presented in three parts. The first part illustrated the demographic information of the respondents. The second part reported data on mentoring using descriptive and inferential statistics. The final part presented the results of correlational and regression analyses regarding the dominant factors affecting the success in science project competition based on mentoring. Demographic data of the respondents is presented in Table 2. The respondents in this study were 250 students comprised of 44% male and 56% female. The respondents were students in junior high school (47%) and senior high school (53%). Majority of the students were studying in public schools (74%), while only 26% were studying in private schools. Out of 250 students, 56% of them were 13 to 15 years old, and 44% were 16 to 18 years old.

Table 2. Demographic information of the respondents

Item	n	(%)
Gender:		
Male	110	44.00
Female	140	56.00
Total	250	100.00
Level of schools:		
Junior High School	117	46.80
Senior High School	133	53.20
Total	250	100.00
Type of Schools:		
Public School	186	74.40
Private School	74	25.60
Total	250	100.00
Age groups:		
13-15 years-old	141	56.40
16-18 years-old	109	43.60
Total	250	100.00

To examine the effectiveness of mentoring perceived by the students, a set of questionnaires was distributed to the students. In the questionnaire, the five-points Likert scale provided the options of strongly agree (5), agree (4), not sure (3), disagree (2), and strongly disagree (1). Six items on the relationship between the students and their mentors were posed to the students and the result showed that, in general, the students strongly believed (M = 4.40; SD = 0.52) that they had positive relationship

with their mentor. The positive relationship between the students and their mentors shown through the students' comfortable feeling when discussing with their mentors (M = 4.50; SD = 0.62), the mentors' honesty to the students (M = 4.44; SD = 0.66), the mentors' care about the students' emotion (M = 4.43; SD = 0.72), the safe feeling of the students when being together with their mentors (M = 4.42; SD = 0.66), the ability of the mentors to calm the student's stress (M = 4.39, SD = 0.69), and the willing of the mentor to spend their time with the students in completing the science projects (M = 4.22; SD = 0.88).

Regarding the effectiveness of the supervision in the preparation to participate in science project competition, the students strongly agreed (M = 4.49; SD = 0.41) that they had been supervised properly regarding science project competition. Most of the students strongly believed (M = 4.66; SD = 0.51) that the mentors cared of the students' emotion. Moreover, the students highly concurred (M = 4.61; SD = 0.50) that the mentors appreciated their contributions in their science project. In addition, the students agreed (M = 4.33; SD = 0.75) that their mentors never made fun of them if they made mistake. The students strongly agreed (M = 4.41; SD = 0.67) that their mentors tried not to make the students felt ridicule when they committed a mistake. The students also strongly agreed (M = 4.55; SD 0.56) that their mentors showed appreciation to the students in front of other students. The students agreed (M = 4.13; SD = 0.95) that their mentors did not show their negative expression when they were not happy in front of the students. The students also agreed (M = 4.34; SD = 0.77) that their mentors avoided to be rude to them. Furthermore, the students strongly convinced (M = 4.52; SD = 0.67) that their mentors never told the students that the students were incompetent. Finally, the students strongly agreed (M = 4.60; SD = 0.58) that their mentors encouraged them to interact with other people with respect.

In relation to communication between the students and their mentors, in general, the students strongly believed (M = 4.40; SD = 0.37) that they have good communication with their mentors during the mentoring process. The students strongly agreed (M = 4.38; SD = 0.65) that their mentors praised them after they have done a good job that requires substantial effort. The students strongly agreed (M = 4.34; SD = 0.72) that their mentors avoided making negative comments about them to others. The students also strongly agreed (M = 4.28; SD = 0.62) that in discussion with the students, the mentors focused on the students' needs. In relation to discussion on the science project, the students strongly agreed (M = 4.43; SD = 0.55) that their mentors welcomed inputs from the students when discussing about the students' science project. Moreover, the students agreed (M = 4.33; SD = 0.62) that in facing new problem, their mentors would rather listen to the students' opinion first. The students also strongly agreed (M = 4.46; SD = 0.55) that their mentors listened patiently to the students' thoughts. Next, the students strongly convinced (M = 4.49; SD = 0.54) that their mentors welcomed feedback from them. Moreover, the students strongly agreed (M = 4.44; SD = 0.63) that their mentors used positive gestures and facial expressions when talking with them. The students strongly agreed (M = 4.47; SD = 0.62) that their mentors explained using simple analogy when the students did not understand a concept. Finally, the students strongly agreed (M = 4.36; SD = 0.61) that their mentors asked the students' suggestions on how to solve the problem in their science project.

The students were posed with eight items regarding role model to reflect mentoring process. In general, the students strongly agreed (M= 4.44; SD = 0.39) the mentors as their role model. The students believed (M = 4.50; SD = 0.62) that their mentors proofread the students' writing before submission. The students also strongly agreed (M = 4.49: SD = 0.56) that their mentors provided them with feedback on their work. Regarding conducting research, the students convinced (M = 4.44; SD = 0.72) that their mentors have conducted several science projects. The students also strongly agreed (M = 4.49; SD = 0.70) that their mentors provided extra time (for example after school) for them for consultation. The students also convinced (M = 4.43; SD = 0.62) that their mentors' attitude becomes a role model for the students. Nevertheless, the students concurred (M = 4.31; SD = 0.69) that their mentors were not angry when they made a mistake in doing science project. The students believed (M = 4.44; SD = 0.57) that their mentors patiently guided the students' science project. Finally, the students strongly agreed (M = 4.39; SD = 0.70) that their mentors were enthusiastic when guiding the students' science project.

The findings on the research skills have shown, in general, the students believed (M = 4.38; SD = 0.50) that their mentors' research skills have assisted the students to complete their science project. Most of the students strongly agreed (M = 4.46; SD = 0.63) that their mentors guided them to find relevant information to support their science projects. The students concurred (M = 4.36; SD = 0.73)

that their mentors suggested relevant resources to them. The students convinced (M = 4.18; SD = 0.74) that their mentors guided them to create a time line for their science project. Finally, the students strongly agreed (M = 4.50; SD = 0.67) that their mentors reminded them the importance of completing their science project on time.

Next, eight items were posed to the students on coaching. In general, the students strongly believe (M = 4.46; SD = 0.40) that they were effectively coached by their mentors to win science project competition. The students concurred (M = 4.34; SD = 0.59) that their mentors were accessible to them to discuss about their science project. Majority of the students strongly agreed (M = 4.55; SD = 0.55) that their mentors supported and encouraged them in completing their science project. The students also convinced (M = 4.42; SD = 0.58) that their mentors provided proper guidance to them on the science project design. Moreover, the students strongly agreed (M = 4.57; SD = 0.55) that their mentors provided them with suggestions to improve their science project. In relation to the role of the mentors as advisors, the students strongly believed (M = 4.54; SD = 0.53) that the mentors gave advice to them in appropriate way. Furthermore, the students strongly agreed (M = 4.38; SD = 0.62) that their mentors showed appreciation when they told their thoughts or feelings. Regarding sharing experiences, the students strongly convinced (M = 4.48; SD = 0.60) that the mentors preferred to use their positive experiences in discussion. Finally, majority of the students agreed (M =4.37; SD 0.61) that after discussion, the mentors preferred to have group consensus.

The total average of mentoring factors was illustrated in Table 3. In general, the students convinced (M = 4.43; SD = 0.32) that they experienced positive mentoring from their mentors. Regarding effectiveness mentoring from the students' perspective, majority of the students strongly agreed (M = 4.49; SD = 0.41) that their mentors provided supervision to them, as well as coaching (M = 4.46; SD = 0.40). The students also concurred that their mentors built positive relationship (M = 4.40; SD = 0.52) and communication (M = 4.40; SD = 0.37) with them. In addition, the students strongly agreed (M = 4.38; SD = 0.50) that their mentors possessed research skills.

Table 3. The total average of mean and standard deviation of mentoring from the students' perspective

Factors of Mentoring	M	SD
1. Relationship	4.40	0.52
2. Supervision	4.49	0.41
3. Communication	4.40	0.37
4. Role Model	4.44	0.39
5. Research Skills	4.38	0.50
6. Coaching	4.46	0.40
Total Mentoring	**4.43**	**0.32**

Four independent sample t-tests were conducted to compare the mentoring perceived by male and female students, the students in junior and senior high-schools, the students in public and private schools, and the students in the age groups of 13 to 15 years-old and 16 to 18 years-old. The result of the t-test on gender indicated that there was no significant difference on mentoring as perceived by the male and female students [t(248) = -0.935, p = 0.351], with the mean of mentoring perceived by the male students was 4.41 (SD = 0.32) the female students was 4.45 (SD = 0.31). Regarding the school level, the result indicated that there was no significant difference on mentoring as perceived by the students in junior and senior high schools [t(248) = -1.447, p = 0.149], with the mean of mentoring perceived by the students in junior high school was 4.39 (SD = 0.31) and the students in senior high school was 4.45 (SD = 0.32). Moreover, the independent sample t-test indicated that there was no significant difference on mentoring as perceived by the students in public and private schools [t(248) = -0.414, p = 0.679], with the mean of mentoring perceived by the students in public school was 4.43 (SD = 0.32) and the students in private school was 4.44 (SD = 0.33). The result of the fourth independent sample test indicated that there was no significant difference on mentoring as perceived by the students in the age group of 13 to 15 years-old and 16 to 18 years-old [t(248) = -0.766, p = 0.445], with the mean of mentoring perceived by the students the group age of 13 to 15 years-old was 4.41 (SD = 0.29) and the students in the group age of 16 to 18 years-old was 4.44 (SD = 0.34).

Finally, an open-ended question was posed to the students about their mentors regarding mentoring process on the preparation to science project competition. The answers from the students were presented in Table 4. The students listed three traits of their mentor's good mentoring, the first one was the mentors' role as advisor (58.0%), second was their mentors' encouragement to the students (33.6%), and third was the fact that their mentors were accessible (24.0%).

Table 4. Characteristics of good mentor from the students' perspective

Rank	Factors	Percentage (%)
1	Advising	58.4
2	Encouraging	33.6
3	Accessible	24.0

Correlational test was conducted to examine the relationships among the six factors of mentoring, and the result presented in Table 5. The Pearson coefficients for all correlations among the six factors of mentoring were statistically significant at the level of $\alpha = 0.01$. However, there was one weak correlation [r(248) = 0.246; p = 0.000] between research skills of the mentors and relationship between the students and the mentors from the students' perspective. Nevertheless, there were fifteen moderate relationships varied from [r(248) = 0.325; p = 0.000] to [r(248) = 0.623; p = 0.000]. Regarding relationship between the factors and mentoring, it can be seen from Table 6 that there were moderate relationships between mentoring and relationship [r(248) = 0.680; p = 0.000] and between mentoring and research skills of the mentors [r(248) = 0.621; p = 0.000]. Furthermore, there were strong relationships between mentoring and communication [r(248) = 0.812; p = 0.000], mentoring and supervision [r(248) = 0.810; p = 0.000] and between mentoring and role model [r(248) = 0.810; p = 0.000]. Therefore, relationship, supervision communication, role model, research skills, and coaching, were positively linked representing mentoring from the students' perspective in the context of science project competition.

Table 5. Pearson coefficients of correlations among mentoring factors from the students' perspective

Factors		1	2	3	4	5	6	Mentoring
1. Relationship	Pearson	1	.562**	.439**	.363**	.246**	.325**	.680**
	Sig (2-tailed)		.000	.000	.000	.000	.000	.000
2. Supervision	Pearson	.562**	1	.623**	.548**	.339**	.413**	.810**
	Sig (2-tailed)	.000		.000	.000	.005	.000	.000
3. Communication	Pearson	.439**	.623**	1	.589**	.375**	.501**	.812**
	Sig (2-tailed)	.000	.000		.000	.000	.000	.000
4. Role Model	Pearson	.363**	.548**	.589**	1	.488**	.604**	.800**
	Sig (2-tailed)	.000	.000	.000		.000	.000	.000
5. Research Skills	Pearson	.246**	.339**	.375**	.488**	1	.526**	.621**
	Sig (2-tailed)	.000	.000	.000	.000		.000	.000
6. Coaching	Pearson	.325**	.413**	.501**	.604**	.526**	1	.723**
	Sig (2-tailed)	.000	.000	.000	.000	.001		.000
Mentoring	Pearson	.680**	.810**	.812**	.800**	.621**	.723**	1
	Sig (2-tailed)	.000	.000	.000	.000	.000	.000	

** Correlation is significant at the 0.01 level (2-tailed)

To determine the significant factors of mentoring, step-wise regression was conducted. In order to determine the factors which influencing the success of the students in science competition, Table 6 indicated that communication and coaching were dominant factors which significantly influencing mentoring in the context of science project competition as perceived by the students. Table 7 presented the result of the Analysis of Variance (ANOVA) test of communication and coaching as the predictors of achievement in science project competition. The result of the test indicated that the influence of communication and coaching toward the achievement in science project competition was significant [F(2,147) = 4.618; p = 0.11].

Table 6. The model summary of communication and coaching as factors of mentoring

	R	R^2	Adjusted R^2	Standard Error of the Estimate
Communication, Coaching	.243	.059	.046	.800

Table 7. The ANOVA test for mentoring perceived by the students.

	Sum of Squares	df	Mean Square	F	Sig.
Regression	5.911	2	2.956	4.618	.011[a]
Residual	94.089	147	.640		
Total	100.000	149			

[a]Predictors: (Constant), Coaching, Communication
[b]Dependent Variable: Achievement

Table 8. The coefficients of regression for mentoring perceived by the students

Factors	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	3.745	.809		4.628	.000
Communication	-.551	.216	-.264	-2.546	.012
Coaching	.601	.207	.300	2.898	.004

[a]Dependent Variable: Achievement

The coefficients of regression of communication and coaching as predictors to the achievement in science project competition were illustrated in Table 8. The result of regression suggested that both communication (β = -.551) and coaching (β = .601) were significantly contributed in the influence of mentoring toward the achievement in science project competition. These quantitative results were supported by the answer of the students on the open-ended question, that they were expecting their mentor play the role as coach, such as providing advice, encouragement and being accessible during the process of mentoring. Moreover, the interview data with the selected informants were supporting the regression results. As one of the students stated:

> "When I failed to complete task from my mentor, I was expecting my mentor to give me advice in order to get better result".

Another student mentioned his opinion about a good mentor as:

> "A good mentor should take a role as a 'friend' instead of 'teacher', which made me comfortable to share problems in the science project. He would never under-estimate my opinions or offend me. If he acts as teacher, I am afraid he will blame me on my mistakes. As good mentor, he will provide me with appropriate advice."

CONCLUSION AND IMPLICATIONS

The aim of the study was to identify the role of mentoring to win science project competition in Indonesia. In this study, mentoring consisted of six elements – relationship, supervision, communication, role model, research skills, and coaching. The empirical data from the questionnaire showed that the most rated mentoring skills by the students was supervision, followed by coaching, role-model, and communication. Whereas the lowest mean in mentoring is research skills. The students perceived supervision as getting constructive and useful inputs from the mentors on the science project. In addition, the findings also revealed that the mentors supervised the students during the completion of the science project by suggesting some ideas for their students' research. The quantitative data from the questionnaire to the students showed that the second highest mean of mentoring was coaching. The students perceived coaching as support from the mentors by providing suggestions to improve the students' research work. This key finding was supported by the result of open-ended items related to characteristics of a good mentor, which stated that the teachers were expected to provide advice to the students in the completion of their research work.

In addition, the results of the questionnaire showed that supervision and coaching were perceived as support from the mentors in providing information which was expected to improve the quality of the research conducted by the students. In both supervision and coaching, the mentors were expected to play his/her role as advisor. This finding was supported by the qualitative data form both the open-ended item and interview regarding the characteristics of a good mentor in the context of science project competition. Next, the element of mentoring which was rated as the third highest in mean – was a role model. In the context of science project competition, a role model was perceived by the students as the effort of the mentor in guiding the students' research. In the open-ended section, students stated characteristics of a good mentor such as supportive behaviors. Mentors' supportive behaviors in the context of mentoring for science project competition included giving advise and suggesting resources to the students. McSheck (2012) stated that as a role model to the students, a mentor could be a helper, guide, teacher, facilitator, and friend.

The quantitative data in the present study showed that the students rated communication highly, in the context of science project competition. With regards to communication, the students perceived it as the mentors' openness to welcome feedback from the students. The second important mentoring skill is relationship. The students perceived relationship in the context science project competition as the effort of the mentors to make the students comfortable in discussions with the mentors. This key finding was supported by the qualitative data from the open-ended items related to characteristics of a good mentors – which revealed that the mentors were expected to possess positive behaviors. Several positive behaviors of the mentors stated by the students that were expected to reduce the students' stress were being fun, cheerful, having sense of humor, funny, smiling, sociable, never made fun of the students, and giving hope. In the interview session, the students added patience as positive behaviors of the mentors. The lowest mean from the students' questionnaire was research skill. The result of the survey showed that the students perceived research skills as not as important as the other mentoring skills. The interview and open-ended data showed that students believed that a good mentor should be accessible to the students. However, there was no evidence showing how much the mentors provided their time for students to complete their research work. Nevertheless, according to Nejatizadeh et al. (2016), the main constraint in conducting research was insufficient time.

In conclusion, the effective mentoring in the context of science project competition was reflected from the process of the supervision and coaching, role model of the mentors, and communication between the students and the mentors. In mentoring science project, the mentors were expected to provide support to the students. The support can be in the form of providing professional inputs which in line with the subject of the science project, or suggestions to improve the science project. Moreover, the students saw the mentors as the experts who could help them to improve they research project. Nevertheless, there was a need to have mutual relationship between the students and the mentor in the mentoring process. Several examples regarding the mentors' positive behaviors to reduce tenses of the students are being fun, cheerful, having sense of humor, smiling, sociable, never made fun of the

students, and gave hope. In implications, based on regression analysis, the most influencing factors of mentoring were communication and coaching. A new mentoring framework based on the empirical data in this study could be developed. This framework could be used by teachers and students in schools that will participate in future science project competition. Another strategy to win science project competition is to enhance teachers' capability in coaching their students' in the context of participation in science project competition Even though the study was conducted in ten provinces in Indonesia, the results can be applied to students in other countries.

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