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Student Self-Description of Mathematical and Verbal Skills and Mathematical and English Achievements

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Abstract

This study analyzed and described the respondents' self-description of mathematical and verbal skills, together with mathematical and English Language achievements, among 90 male and 90 female students at a private high school in Indonesia. Correlations of both mathematical and verbal skills with both mathematics and English achievements were investigated, along with the size of their effect. The findings showed that the students had average levels of mathematical and verbal skills, an above average level of mathematics achievement, and an average level of English achievement. Significant differences were found in the self-description of verbal and mathematical skills, and the achievements in an English subject for female and male students. Female students returned significantly higher scores for their self-description of verbal skill as well as English achievement, while male students did so only for their self-description of mathematical skill. Both self-description of mathematical and verbal skills simultaneously had a positive and significant association with mathematics and English achievement.

Keywords: *Verbal skill, mathematical skill, mathematics achievement, English achievement*

Introduction

Issues of gender difference in student performance in mathematical and verbal skills have been addressed in many reviewed studies. Nevertheless, the research findings on this issue do not seem to be consistent. In Indonesia, high school students often consider themselves, or are considered as more intelligent when they excel in mathematic compared to those who can only study language. Even their parents take pride among their friends if their children study mathematics and science, rather than language. They still hold the notion that children who are able to study science and mathematics have better job prospects than their school mates who are good in language skills. A statement such as "I've chosen to study language because I am not smart in math" is common among Indonesian students. This kind of problem needs to be investigated.

Moreover, studies have shown that there is a difference between female and male students in terms of their academic achievement, wherein this difference can affect their success in their future career (Oppong-Sekyere et al., 2013; Karthigeyan & Nirmala, 2012). Female students were found to have better performance in English when compared to their male peers (Begum & Phukan, 2001; Karthigeyan & Nirmala, 2012; Younger, Warrington, & Williams, 1999). Some research results, however, show inconsistency in terms of the relationship between gender and achievement. Therefore, it requires more investigation.

Academic achievement has become one of the best predictors of student future success in a career. There is a growing concern among parents and teachers about their children's academic performance, particularly when it is connected with gender difference. This problem has generated considerable interest in educational evaluation over the years (Abdullahi & Bichi, 2005). In addition, academic achievement has been more and more emphasized as far as attainment of educational goals are concerned, because it has become one of best predictors of student success.

Mathematical Skills

Mathematical skills refer to ability to reason effectively in 10 varied situations: problem solving; applying mathematics to everyday situations; alertness to the reasonableness of results; estimation

and approximation; appropriate computational skills; geometry; measurement; reading, interpreting, and constructing tables, charts, and graphs using mathematics for prediction; and computer literacy (National Council of Mathematics Supervisors, cited in Körtesi & Georgieva, 2015).

Every human being is faced with various problems that need to be solved on a daily basis. Students have problems in scheduling subjects, time management, social life, and health while doing their assignments. They often are confused about their learning strategy, such as how to gain a high grade while the family issues keep distracting their focus. When those problems appear, they begin to think of how to solve all the problems in an efficient and effective way. In reality, they are dealing with mathematic-related skills.

Skeel and Keiper (2001) suggested that mathematical skills involve the area of numerical analysis and improvement in problem solving. Chambers (2008, p. 7) constructed the idea of mathematics as a consideration of "objective facts, a study of reason and logic, a study of purity and beauty, free from societal influences, self-contained, interconnected structure." Realizing that mathematical skill deals with calculating, numerical analysis, logical analysis, and problem solving, it plays a very important role in every aspect of human life. Asbury University's (2012) researchers assert that mathematical skill is introduced to a basic skill set in the context of practical problem solving. Therefore, it becomes obvious that mathematical skills deals with the logic and systematic area. Furthermore, what Asbury academics were trying to explain was that mathematical skills logically deals with human lives especially with students' daily lives. Students often face many problems and the characteristic of mathematic science requiring the application of mathematical skills.

Mathematical skills include numerical and logical analyses in order to solve problems. Bradie (2006) explained that complexity seems to be an element of mathematics that requires the induction of deep analysis by learners in order to develop their ability. Real life application by students deals with various activities that lead them to get involved in developing strategies in finding reasonable solutions. Not surprisingly, many numerical methods have been used to help students in examining the problems that they find in the real-life.

How student analyze using logic is termed logical analysis. According to Gardner (1999, p. 170), it is "the logical entry point [that] galvanizes the human capacity to think deductively [so that] many events and processes can be conceptualized in terms of syllogisms." Individuals can not only come to understand their ability in analyzing logically but also deploy them in highly flexible and productive ways within the human roles that various societies have created. Logical analyzes can be mobilized at school, at home, at work, or on the street. It is crucial for students to think logically and analyze issues logically, as well to avoid making decision based on uncertain emotion.

Moreover, one of the mathematical skills is problem solving. Problem solving is needed for humans in order to survive. Isaken, Dorval, and Treffinger (2011, p. 19) defined problem solving as "the act of answering questions, clearing up uncertainties, or explaining something that was not previously understood." Thus, by learning and exploring in the area of mathematics, students can acquire proficiency to solve their own problems.

Verbal Skills

Verbal skill commonly refers to a person's ability to use kinds of words, phrases, sentences, and paragraphs or even a discourse, wherein the individual can comprehend their meanings. The American Heritage Dictionary of the English Language (2012) simply defines verbal skill as the spoken skill. Students can learn about the communication processes. Understanding how to improve it results in increasing their grades in learning. Logan (2012, p.1) stated that "in contemporary society, verbal skills are of paramount importance." Students may be motivated to improve their verbal skills, but they cannot do this if they do not know what to do. Students who can make conversation with their friends or have a good public speaking ability are categorized as having verbal skills. Speakers who are good in verbal skills have the ability to speak and use words, or in other word, have ability in communication. In school, students can develop their verbal skill in every activity that is provided by the teacher or school program where students need to use English for communication.

The success of learning is related to the student behavior. Rightly or wrongly, people make assumptions about a person's intelligence, education, and capabilities according to words that are said (Elster, 2000). Verbal skills help students to confidently verbalize their knowledge to other people. In order to learn verbal skills, the student should practice, but they also need to experience real-life exposure so that they become accustomed to communicate in English.

Verbal skill helps the students in many aspects of learning in school, such as interacting with others, learning and participating in school, and also developing themselves to communicate with others. When the learners undertake the tasks above, they prepare to make and adjust decisions about how they perform in verbal skill, such as reading, speaking and listening. To develop these skills, the students should be studying these aspects very well.

Through continuous practice, students can improve their reading skills. The major point to reading is to comprehend the ideas in the material. Reading without comprehension is empty and meaningless. Students must understand theories of reading comprehension, of which Gunning (1996) identified three main theories. The first was Schema Theory, which is the organized knowledge that one already has about people, places, things, and events. Kitao (1990) said that the Schema theory involved an interaction between the reader's own knowledge and the text, which results in comprehension. The second aspect of comprehension is dealt with in the Mental Model Theory. According to this theory one constructs a mental model of what is happening when reading. This is updated as more information is gained, but all the time the reader keeps the important thing about the main character in the foreground (Gunning, 1996). The last aspect of comprehension is handled by Proposition Theory. This theory can involve the readers to constructing the major ideas and the content as they process the text. So, reading will impact the verbal skills in English achievement.

The students can learn something by listening. O'Connor (1980, p. 1) said that "language starts with the ear". Gilman and Moody (1984) considered that 40-50% of adult communication time involves listening. Students will spend more time in listening when they enjoy it. Students can make listening their habit, particularly listening to the spoken English to improve their achievement. According logic behind audio-lingual methods is that listening plays an important role. To repeat and develop a better pronunciation for speaking an individual just has to listen.

Speaking skill is crucial for students to improve their verbal skill. When students study English they should be brave to speak, because it is the only way to improve speaking skills. A study by Podlozny (2000) suggested that the use of drama was effective in the development of understanding and language; this was more effective than engaging in more instructional time. Gaining confidence in speaking and getting rid of false ideas about pronunciation are important in all studies. In addition, most learning is based on words. Communicative competence is the goal. So, speaking skill must be practiced constantly and the teacher must take a part in the development of students speaking skill. Watching TV, listening to cassettes and practicing with partners or foreigners can support the student speaking skill development.

Language and mathematics are used to describe and reflect on theories connected with people. Commonly, students look at these two sciences and consider that they are applied to very different skills and areas. Language and mathematics sciences develop particular skills; however, similar methodologies are used in each area. Both skills required logical and syntactical thinking (Liversidge, Cochrane, Kerfoot, & Thomas, 2009). If students deal with mathematics subjects every day, it means that they are using their logic and refining the syntactic approach. Students use the same approaches in studying English language. According to the British National Advisory Committee report (1999), every person, especially students, need to realize that both mathematical and verbal skills are related. They support each other in terms of logical thinking and achievement. Furthermore, the report emphasized that language science cannot be achieved without understanding the deep meaning of mathematical approaches. The process of learning mathematics, then, will be reflected in English skills and contribute continuously to English achievements.

All these considered, it can be assumed that verbal skill affects English language achievement. The first year in high school is a crucial time for students because that is the time to increase their

knowledge before they go to the second year or third year. To gain success and achieve great improvement is not as simple as it may appear. Learners may experience difficulties, exhaustion, and stress from various tasks that they need to undertake. In order to achieve the purposes of this process, student need clear strategies, which include sound acquisition, grammar, vocabulary, listening comprehension, learning to talk, learning to write and learning to read.

The purpose of this study was to investigate self-described mathematic and verbal skills of private high school students in Tomohon City, North Sulawesi, Indonesia. It also sought to compare the two skills and achievements based on the respondents' gender. Ultimately, this study was intended to find out whether mathematical and verbal skills can simultaneously affect mathematic and English achievements.

Methodology

This quantitative study was descriptive. It was intended to explore the respondents' self-description of their mathematical and verbal skills, to compare the dependent variable based on gender, and to investigate the relationship among those variables with their English achievement.

Participants

A purposive sampling method was employed in this study, wherein 180 students of a private high school were selected as respondents who provided the data to be analyzed. Located in Tomohon City, this high school was known as one of the best private high schools in North Sulawesi Province, Indonesia. The participants consisted of 90 female and 90 male students, who were enrolled in the first semester of school year 2015-2016. In addition, 30 students participated in a pilot study in order to explore the validity and reliability of the questionnaire used.

Instrument

The instrument utilized in this study was adapted from the Self-Description Questionnaire II -Short (SDQII-S) version by Ellis, Marsh, and Richards (2002). It was psychometrically validated by Marsh, Ellis, and Richards (2005). All items relating to verbal self-concept statements and all those items dealing with mathematical self-concept statements were picked out (10 items each category) to construct the questionnaire used in this study. Each of the items in the construct was assessed using a 6-point Likert scale, which bears the following description: 1 = false (not like me at all); 2 = mostly false; 3 = more false than true**;** 4 = more true than false; 5 = mostly true; 6 = true very much like me (describes me well).

The 20 items were translated into Indonesian language. The questionnaire was distributed to 30 students who were selected to generate data for statistical validity and reliability purpose. The collected data were analyzed using Statistical Package for the Social Sciences (SPSS) software.

First, a correlation score of each item dealing with mathematical skill was sought with the total score of all items dealing with such skills. It was found that there were four items not significantly correlated with the total score of mathematical skills. The four items, namely items 4, 10, 25, and 27, were then invalid and thus removed from the construct. Secondly, a correlation score of each item dealing with verbal skills was sought with the total score of all items pertaining to such skills. It was found that items 2 and 9 were not significantly correlated with the total score of all items of verbal skills. Therefore, in total six items were removed from the instrument and 14 items remained: 6 valid items in the mathematical skill area, and 8 valid items in the verbal skill area. All these valid items were then examined for their reliability. The result of reliability analysis gave a Cronbach $\alpha = 0.809$. This indicated that all the valid items were also reliable.

Statistical Analysis of Data

A 6-point Likert scale questionnaire data was analyzed by using SPSS software. Descriptive statistical analysis was employed by calculating the mean scores of the data gathered for variables

under study, namely mathematical skills, verbal skills, mathematic subject grade, and English subject grade.

An independent sample *t*-test was used to compare the gender differences in mathematical skill, verbal skill, mathematic course grade, and English Language course grade results. The bivariate Pearson correlation approach was employed to examine whether there was a significant relationship between independent and dependent variables, by analyzing the correlation coefficient *r* and probability value *p*. The correlation coefficient *r* was utilized to determine the direction of the correlation, whether it was positive or negative, as well as the strength of the relationship. Besides, Pearson's partial correlation formula was employed to analyze the correlation between one independent variable and one dependent variable, while controlling another independent variable. Such an analysis helped to explore whether or not two independent variables could simultaneously give significant effects on a dependent variable.

Interpretation of Data

The interpretation of the average score of the mathematical and verbal skills was in accordance with the six levels of the Likert scale as follows:

1.00 – 1.49 = Very Low
1.50 – 2.49 = Low
2.50 – 3.49 = Average
3.50 – 4.49 = Above Average
4.50 – 5.49 = High
5.50 – 6.00 = Very High

The data collected for mathematic and English achievements referred to students' final test scores. It utilized percentages, which were interpreted in accordance with the description prescribed by Kementerian Pendidikan Indonesia (Ministry of Education) as follows:

< 69 = Poor
70-79 = Average
80-89 = Above Average
90-100 = Excellent

In order to determine whether there was a significant difference or correlation between variables, a significance level of $\alpha = .05$ was adopted.

Results

In order to employ correlational analysis, it is important first to conduct analyses of data normality of variables relating to the self-description of mathematical and verbal skills as well mathematic and English achievements. Descriptive, comparative, and correlational statistical analyses were conducted thereafter.

Data Normality of Variables

Prior to correlation analysis, the assumption of data normality must be met. Kolmogorov-Smirnov test was used to explore whether the data were normally distributed. The test was also confirmed with Lilliefors significance correction. As shown in Table 1, the significance value of English achievement, mathematic achievement, self-description of mathematical skills and self-description of verbal skills were all greater than p = .05. These scores met the assumption that the data were normally distributed, implying that correlation analysis for this study was possible.

Table 1. Results of the Application of Kolmogorov-Smirnov Analysis to Self-descriptive Data Relating to Mathematic and English Skills Possessed by Males and Females

	Gender	**Kolmogorov-Smirnov**		
		Statistic	df	Significant*
English Achievement	Male	0.084	90	0.157
	Female	0.088	90	0.079
Mathematics Achievement	Male	0.082	90	0.176
	Female	0.074	90	0.200*
Self-Description of Verbal Skill	Male	0.059	90	0.200*
	Female	0.073	90	0.200*
Self-Description of Math Skill	Male	0.087	90	0.086
	Female	0.074	90	0.200*

*Significant at the 0.05 level

Mathematical Skill and Verbal Skill

The self-description responses of students to both mathematical and verbal skills are displayed in Table 2. The mean score of the student perception of their mathematical skills was 3.30, which was categorized as average. The mean score of their self-description of verbal skill was 3.40, which was categorized as at the above average level. The scores showed a slight difference between mathematical skill and verbal skill, this meant that the respondents had slightly better development in verbal skills than in mathematical skills.

According to the finding shown in Table 2, the mean score of mathematics achievement was 80.04 and the English achievement was 79.44, meaning that the level of mathematics achievement was above average and the English achievement was at an average level. The finding indicated that the students had mastered or acquired sufficient knowledge and skills in both subjects.

Table 2. Descriptive Statistics Applied to Data on Mathematic and English Self-described Skills

	N	Min	Max	Mean	SD
Verbal Skill	180	1.88	5.00	3.40	0.62
Mathematical Skill	180	1.17	5.33	3.30	0.98
Mathematic Achievement	180	52	100	80.04	10.84
English Achievement	180	52	98	79.44	9.98

Female and Male Student Verbal Skill, Mathematical Skill, Mathematics Achievement and English Achievement

The self-described verbal skill mean score for female students was 3.52 and that for male students was 3.27 (Table 3). A further *t*-test, which included Levene's test for equality of variances, gave p = 0.007, which was less than $\alpha = .05$, indicating that there was a significant difference in the self-description of verbal skills between female and male students. Female students scored higher than male students.

Table 3 also shows that the self-description of mathematical skill scores for female and males, M = 3.07 and M = 3.52, respectively. A further *t*-test, which included Levene's test for equality variances, revealed that $p = 0.04 < \alpha = 0.05$, which indicated significance. It was then inferred that there was a significant difference in the self-description of mathematical skill between female and male students, wherein male students significantly outscored female students.

Table 3. Group Statistics and Significant Differences Applied to Data on Mathematics and English Self-described Skills

Skill & Achievement Type	Gender	N	Mean	SD	Sig. (2-tailed)
Verbal Skills	Male	90	3.27	.70	0.007
	Female	90	3.52	.50	
Mathematical Skills	Male	90	3.52	.96	0.002
	Female	90	3.07	.95	
Mathematics Achievement	Male	90	79.38	11.16	0.415
	Female	90	80.70	10.54	
English Achievement	Male	90	76.38	10.77	0.000
	Female	90	82.50	8.09	

Table 3 also shows that mean scores of mathematics achievement for female students was 80.70 and that of male students was 79.38. A further *t*-test, which included Levene's test for equality variances, revealed that the *p*-value was .42. Since this p-value was greater than α = .05, it was implied that the mathematic achievement for female and male students did not differ.

As shown in Table 2, the English achievement of female students was 82.50 and that of male students was 76.38. Application of a *t*-test, which included Levene's test for equality variances, showed that p = .000, which was much less than α = .05, indicating significance for the difference in English achievement. It was inferred that there was a significant difference in the English Achievement between female and male students, wherein the female students scored significantly higher than did the male students.

Correlation of Verbal Skill and English Achievement and Mathematic Achievement

Bivariate Pearson correlation analysis was used to reveal the direction and strength of relationship, and the significance of the relationship. For this relationship, the correlation coefficient (*r* =.598) was categorized as strong according to Cohen (cited in Pallant, 2007), indicating a positive relationship.

As for relationship of verbal skill and English achievement, Table 3 shows that the *p* value was .04 (rounded), which was smaller than significance level α = .05, indicating a significant relationship. The correlation coefficient (r =.155) was positive, indicating a positive direction of the relationship, in spite of its small effect. It could be inferred that there was a positive and significant relationship between students' self-description of verbal skill and English achievement, with a small effect on the dependent variable. In other words, it implied that a higher score in the English language subject was significantly associated with a higher score in their perception of verbal skills.

Verbal skill was also examined for its relationship to mathematic achievement. As shown in Table 4, the p value (.318) was greater than the significance level α = .05, indicating no significant relationship, which was also confirmed by the correlation coefficient *r* = .075).

Table 4 also shows the relationship of mathematical skill and English achievement. The significance value (p = .00) was less than the significance level (α = .05), indicating a significant relationship. The correlation coefficient was positive (*r* = .263). Therefore, it could be concluded that there was positive and significant relationship between student self-description of mathematical skill and English Achievement, with a small effect on the dependent variable. In other words, it implied that a higher score in English achievement was significantly associated with a higher score in students' self-perception of their verbal skill.

As for the relationship between mathematical skill and mathematics achievement, it was shown that the p value was much less than significance level of α = 0.05, indicating a significant relationship. The correlation coefficient (r = 0.413) was positive and indicated a medium effect on the dependent variable (mathematics achievement). Thus, a significant and positive relationship was found between student self-description of mathematical skill and their mathematic achievement.

Table 4. Pearson Correlation between Variables Relating to English and Mathematics Achievements

Skill Type	Correlation	English Achievement	Mathematics Achievement
Verbal Skills	Pearson Correlation	0.155*	0.075
	Sig. (2-tailed)	0.038	0.318
	N	180	180
Mathematical Skills	Pearson Correlation	0.263**	0.413**
	Sig. (2-tailed)	0.000	0.000
	N	180	180

Relationship of Mathematical Skills and Mathematics Achievement, Controlling Verbal Skills

A partial correlation formula, with an inspection of zero-order correlation, was employed to analyze the relationship between mathematical skills and mathematic achievement, while controlling for the scores on self-description of verbal skills. As shown in Table 5, it was found that there was positive relationship (r = 0.413), indicating a medium effect. The probability value (p = 0.00) was smaller than the significance level (α = 0.05), implying that there was a significant and positive relationship with a large effect between mathematical skills and mathematic achievement, controlling for self-description of verbal skills.

A comparison of the zero-order correlation suggested that self-description of mathematical skills alone had a similar effect (r = 0.413) on mathematic achievement. Since the significance values of both relationships were 0.00, they indicated that both self-description of mathematical skills and self-description of verbal skills simultaneously had positive, medium, and significant effects on mathematics achievement. It implied that higher scores in the mathematics subject were significantly associated with higher score of the student self-perception of mathematical and verbal skills. As the students became more confident in expressing their self-perception of mathematical and verbal skills, the more likely they were to show higher scores in the mathematics subject.

Relationship of Verbal Skills and English Achievement, Controlling Mathematical Skills

A partial correlation formula was employed to analyze the relationship between self-description of verbal skills and English achievement, while controlling for the scores on self-description of mathematical skills. It was found that the direction of the relationship was positive (r = 0.155) with a small effect. The probability value (p = 0.00) was less than the significance level (α = 0.05), implying that there was a significant and positive relationship with medium effect between self-description of verbal skills and English achievement, controlling for self-description of mathematical skills.

Table 5. Partial Correlation between Self-Description of Mathematical Skills and Mathematic Achievement, Controlling Self-Description of Verbal Skills

Control Variable	Mathematics Achievement		
None	Self-Description of Math Skills	Correlation	0.413
		Significant (2-tailed)	0.000
Self-Description of Verbal Skills	Self-Description of Math Skills	Correlation	0.413
		Significant (2-tailed)	0.000

A comparison of the zero-order correlation suggested that self-description of verbal skills (Table 6) had a medium effect (r = 0.156) on English achievement with a little bigger effect (r = 0.157) when controlling for self-description of verbal skills. Both of their p values were less than 0.05, indicating that both self-description of verbal skills and self-description of mathematical skills simultaneously had positive and significant yet a small effect on English Achievement. It implied that the better the respondents described themselves in both verbal and mathematic skills, the more likely they were to have higher scores in their English language subject.

Table 6. Partial Correlation between Self-Description of Verbal Skills and English Achievement, Controlling Self-Description of Mathematical Skills

Control Variable			English Achievement
None	Self-Description of Verbal Skills	Correlation	0.155
		Significant (2-tailed)	0.038
Self-Description of Mathematical Skills	Self-Description of Verbal Skills	Correlation	0.157
		Significant (2-tailed)	0.036

Discussion

This study considered students' mathematical and verbal skills and their achievement in mathematics and English subjects and differences between females and males. Primarily, the main purposes of the study were to analyze and to find out the association of self-description of mathematical and verbal skills on their achievement in mathematics and English subjects. This study involved 90 male and 90 female respondents. Further studies may be needed with an increase in the sample size. The inclusion of more schools would allow more generalized findings to be made.

The self-description of mathematical skill fell at the average level; the self-description of verbal skill was at the above average level. On the other hand, mathematic achievement was at the average level, while the English achievement at an above average level. No significant difference was found in the self-description of verbal and mathematical skill or in achievements in the mathematic subject for female and male students. Male students showed significantly higher scores for their self-description of verbal skill.

Students' self-description of mathematical skill was significant and positively correlated with mathematics achievement, with a large effect noted, while controlling for self-description of verbal skill. Students' self-description of verbal skill was also significant and positively correlated with English achievement, with medium effects noted, while controlling for self-description of mathematical skill. The findings of this study revealed that both mathematical and verbal skills were positive and significantly association with achievement in mathematics and English subjects. This finding was similar to that of Liversidge, Cochrane, Kerfoot, and Thomas (2009), who stated that mathematical skill and verbal skills were in the areas of syntactic and logic, leading to both skills being closely related to academic achievement.

This study, however, had some limitations. It did not result in a causal relationship being established between self-description of mathematical skill and mathematics achievement, nor self-description of verbal skill and English achievement. The results of this study can only suggest that enhancing self-description of mathematical skill could be very helpful to the student increased scores in a mathematics subject. Likewise, enhancing self-description of verbal skills could be very helpful to the realization by students of increased scores in an English subject. Increase in self-description of mathematical skill and verbal skill can help the students with their social image, as they socialize with their peers in school more effectively. They may need to invest with confidence in mathematics and English language to rise above against social pressure.

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