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Perceived Effectiveness on the Use of English Language in Teaching Mathematics and Science

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Abstract

This study investigated the perceived level of effectiveness on the use of English in teaching mathematics and science in one bilingual school in Jambi, Sumatra, Indonesia. Students from grades 5 and 6 and six teachers participated in the study by providing data on their experiences in learning and teaching Mathematics and Science using English medium for instruction. A questionnaire was used in this study consisting of the socio-demographic characteristics of the students and teacher, school factors, perceived level of effectiveness on the use of English in teaching mathematics and science. Statistical procedures of descriptive statistics and Pearson correlation using SPSS 20 were used to analyze data. The major findings of the study were (1) most participants perceived that English medium instruction helped them in improving their English reading and writing skills; (2) most participants agreed with the helpfulness of English as a Medium Instruction; (3) there was no significant relationship between teachers' socio-demographic characteristics and the perceived level of effectiveness on the use of English in teaching Mathematics and Science; (4) there was a significant relationship between students' socio-demographic characteristics and the perceived level of effectiveness on the use of English in teaching mathematics and science; (5) there was a significant relationship between school factors such as facilities and equipment with the perceived level of effectiveness on the use of English in teaching mathematics and sciences perceived by students; (6) there was a negative significant relationship between school factors and the perceived level of effectiveness on the use of English in teaching mathematics and science perceived by teachers. Recommendations are also discussed.

Keywords

Bilingual education, English as a medium instruction, mathematics and science

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Introduction

The use of English as medium of communication not only emerged in Western countries but also in Asian countries, for example in Malaysia and Indonesia (Majhanovich, 2014). Some researchers have examined the reasons of English medium for Instruction expansion in terms of broader issues such as economic, social, political and educational forces (Wilkinson, 2013) or institutional policies that encourage student mobility (Altbach & Knight, 2007) and global university rankings. The deliberation of the future needs of a country becomes one of the reasons that influences language policy decisions when it comes to the medium of instruction (Rogier, 2012), and these decisions are often closely linked to the economic concept of globalization (Collins, 2010), with English as medium of instruction, it is believed that it would offer graduates the best opportunities for academic advancement and training as future workers (Byun, Chu, Kim, Park, Kim, & Jung, 2011).

As the first foreign language was incorporated into the Indonesian education curriculum, the public's response to the teaching of English has never declined. Since its introduction as a *muatan lokal* in the 1990s, English teaching has penetrated rural schools that have been taught since Grade 1. The development of the foreign language education is still evolving to the present despite the constraints of teacher availability and teaching resources. Bilingualism in Indonesia is hotly debated by many scholars (Margana, 2015). In 2006, some schools selected by the Ministry of National Education implemented a program known as *Rintisan Sekolah Bertaraf International* (translated as the Pioneer International Standard Schools). These schools were directed to develop English language skills through English bilingual education in Mathematics and Science subjects and to promote habitual English use inside school.

In Indonesia, there are some schools that already implemented the use of English as medium of instruction in the classroom. They use English to teach subjects such as Mathematics and Science. The reason for this is because it will help students to improve their English language skill and help them to be globally competitive. The teacher faces the difficulty on how to teach the students with English as a medium instruction even though they will be guided by textbooks that use bilingual language that provided instructions in both *Bahasa* and English. They find more comfort when they use *Bahasa* rather than English. The teacher sometimes teaches by using first language rather than English.

The understanding of English in Indonesia is still not commendable, because some Indonesians think English is not necessary, so they focus on using their first language to teach and learn in the classroom, especially in Jambi. There are many scientists and Mathematics experts in Jambi who cannot understand English and some instruction used by scientists and Mathematics experts around the globe. For example, when they have international seminar, they face the difficulties in explaining their research and responding when there is question asked by foreign researcher. Sometimes when they want to publish their research, they cannot do it by themselves, but they asked people to translate it. It will be better if they understand it by themselves, so they can express their idea more. That is why, we need to teach them early from elementary, so they can remember and get used to it. But the problem is not all schools in Indonesia especially in Jambi implement English as medium of instruction in their school, only some private and public schools. This study

investigated the perceived level of effectiveness on the use of English in teaching mathematics and science in one bilingual school in Jambi, Sumatra, Indonesia. To achieve the purpose of the study, the following questions guided the study:

1. What is the perceived level of effectiveness on the use of English language in teaching Mathematics and Science as perceived by students and teachers?
2. What is the relationship of teachers and students socio-demographic characteristics and the perceived level of the effectiveness on the use of English in teaching Mathematics and Science as perceived by students and teachers?
3. What is the relationship between school factors and the perceived level of the effectiveness on the use of English language in teaching Mathematics and Science as perceived by students and teachers?

The study tested the following hypotheses:

1. There is no relationship between the teachers' and students' socio-demographic characteristics and the perceived level of effectiveness on the use of English in teaching Mathematics and Science as perceived by students and teachers.
2. There is no relationship between school factors and the level of the effectiveness on the use of English language in teaching Mathematics and Science as perceived by students and teachers.

Literature Review

Socio-demographic characteristics

Age has been associated with the achievement in Mathematics. The Uganda National Examinations Board (2013 as cited by Kiwanuka et al. (2015) reported that the mean scores in Mathematics of younger students in senior two (grade eight) were higher than those of their older counterparts within the same class. However, Ayotola and Adedeji (2009) reported that age had an insignificant negative correlation with Mathematic achievement of senior two students.

Sex difference in language development, shows a clear female advantage in verbal ability, was already well established in the literature (Lovas, 2011). The reasons for these gender differences are still a matter of some controversy although research literature focuses on three major areas to explain differences: biological gender differences in infancy, gender socialization and fathers' influence on language development. Several studies focus on biological factors to account for gender differences (Cho & Holditch- Davis, 2014; Northwestern University, 2008). For example, researchers from Northwestern University (2008) found that brain areas associated with language, work harder in girls during language tasks, and that boys and girls rely on very different parts of the brain when performing these tasks. Furthermore, they found that language processing is more abstract in girls and more sensory in boys. Cho and Holditch-Davis (2014) argued that prenatal exposure to high levels of testosterone, may account for some of these differences. Sex differences are a recurrent theme throughout the literature in academic studies in general and in Mathematics studies in particular. Mathematics is often considered to be a domain in which boys are higher

achievers, both in terms of attitude and self-concept. Contrary to this, findings showed that Mathematics school achievement and grades did not differ significantly between boys and girls (Skaalvik & Skaalvik, 2004).

Educational attainment of parents, parents are the supporters of the education of their children. They give financial support and also they help them at home. Educational attainment of parents refers to the highest education level that parents have completed. Some researchers found out that this factor also affects the students' achievement in the school. According to Kainuwa and Yusuf (2013), there exists a difference between children of educated parents and students with parents having completed only primary school or not. They further state that fathers of with university degree; their children perform considerably well and get the highest score in examination.

Family income, the family income, high or low, can have its impact on student's achievement in all their learning years. Since they are in their early years, their family income can affect their education. Some schools and colleges may look carefully to this point. They may ask for family resources and how they can pay their tuition. Otherwise, they may not have a place in that college. If the family has a high income at the early stage of the student learning, it may help him/her in that school. This could make a huge difference from students whose family has a high income in his late learning (Humlum, 2011). Another difference is the environment impact of the families with high/low income to their children is learning. Some students from low-income families have difficulties to understand or learn. Their vocabulary is less and not that much compared with the other students from different background. Also, their way of learning and understanding is different from others, because their parents may not help them at home or they have single parent. If they are poor, then their parents work all day for them, they have no time to help their children with homework. Another thing is the stress they have and their family at home. These may affect their grades because no one will help them or even, sometimes, care about their success in schools (Jensen, 2013). Some schools help and support students from low-income families. They provide them with computers and some materials for better learning. These kinds of schools are built to help these students outside schools (Demski, 2011).

Teacher education level and teacher's preparation

Teachers are the ones who facilitate teaching and learning process. They are the ones who guide students in the teaching and learning process. The more professional are the teachers, the more strategies and techniques that they will use to support the teaching and learning process. Buddin and Zamarro (2009) found that "Advanced level teachers' educational degrees had no bearing on students' gain" (p. 104). The effect of teachers' professional qualification of student achievement was also not significant in this study. Teachers who were more qualified academically and professionally did not reveal excellent results as compared to those less professionally sound and qualified. Buddin and Zamarro (2009) noticed that teacher quality has a considerable effect on the student achievement, but the qualification in both academic and professional showed a negative correlation effect on student achievement.

A value-added study in Louisiana in 2008 of more than 1,200 new Mathematics, reading, language arts, Science, and social studies teachers from 10 school districts found that certified teachers were more effective than uncertified teachers in increasing their students' achievement. Noell, Porter, Patt, and Dahir (2008) analyzed the state test scores of students in grades 4-9 and found negative impacts on student performance linked to teachers' lack of training within the field in which they were teaching. The findings were statistically significant (at $p<0.001$), and particularly large effects were found for Mathematics, language arts, and social studies teaching. The researchers concluded that teachers who were certified in the content area they were teaching were more effective than those not certified to teach that content. A well-controlled 2005 study used longitudinal, individual- level data for 132,000 students from Houston to examine 4th and 5th graders' achievement gains on six different reading and Mathematics tests over a 6-year period. Researchers, Darling- Hammond, Holtzman, Gatlin, and Heilig (2005) found that certified teachers consistently produced stronger student achievement gains than did uncertified and alternatively certified teachers, including Teach for America (TFA) recruits. Controlling for teacher experience, degrees, and student characteristics, uncertified TFA recruits were less effective than certified teachers and performed about as well as other uncertified teachers. TFA recruited who stayed in teaching and became certified after two or three years did about as well as other certified teachers in supporting student achievement gains; however, nearly all had left teaching after three years.

Teaching mathematics and science using English instruction

Teaching Mathematics and Science is not easy since it is related to calculation, understanding of concepts, principles, and relationship of Mathematic with other subjects, so many teachers and students find it hard. The reasons why Mathematics is difficult to learn is that the concepts in Mathematics are abstract and are difficult to understand, and also the students have alternative meaning of certain Mathematics words before any Mathematics teaching takes place. Sometimes students find that Mathematic is a boring subject. They have low motivation in learning Mathematics, so they do not have intrinsic motivation in learning; the same as in Science, some students also find that Science such as biology, physic and chemistry are boring subjects. Students' dislike for Mathematics may have stemmed from psychological incidences such as fear, endurance, and perseverance, and associated factors. Mathematics and Science curriculum may have not much relevance to real life situation, and also Mathematics teachers are not interested in the subject and do not help their students by way of catering to individual differences.

Since Mathematics and Science knowledge and skill are delivered through language, so language plays an important role in order to support the improvement in these subjects. The use of English as medium of instruction in Mathematics and Science can help students improve not only their academics in both subjects but also their performance in English language skill itself (Nor, Aziz, & Jusoff, 2011). This may create unfamiliarity to those concepts taught to them and may slow down or retard their Science and Mathematics learning. Sudden change to the current Science and Mathematics medium of instruction may

also cause cultural shock to the students. Normally, students' conceptions of prior experience and knowledge influence students' learning in Science and Mathematics.

English education in Indonesia

In Indonesia, English Education is one of the most important subjects. Various ways have been done by the Ministry of National Education, as a breakthrough in order to achieve optimal target of English mastery. The history of teaching English as a foreign language in Indonesia lies long since Dutch colonial times. But the new English is officially taught as a foreign language in Indonesian schools along with the publication of the Decree of the Minister of Education and Culture in 1967. Since then, English teaching has continued to grow. Even since the 2000s English began to be taught in elementary school. The international school was also launched but was later abolished by the Constitutional Court in 2013. Although it has long been included in the curriculum of education in the country, many students admitted that they often face problems when learning English.

English lessons in Indonesia are more on memorizing than understanding. It is felt less supportive in preparing someone to be able to use English in conversations with others and for academic affairs. Some of the students also find that English is difficult because they do not have background knowledge of English and English is not common used by them in their society. The students have low self – confidence when they start to practice speaking in English because they think, they will pronounce it wrongly, that is why English teachers face the difficulty in the classroom when they want their students to actively participate in using English. Some students who are already quite good in English have no place to practice their English, so as time goes by since they do not practice it every day, they already forget and do not know how to use it anymore. Sometimes they lose some vocabulary that they already have before.

Perceptions on English as a medium of instruction

Huang (2015) conducted research to investigate students' perceptions of the English medium instruction courses in terms of their learning motivation, learning anxiety, and learning achievement. 157 students, including 93 local and 64 foreign students participated in the study by completing a students' self-assessment questionnaire on EMI course taking experiences. The major findings of the study were (1) most participants were motivated to take EMI courses to strengthen English ability and professional knowledge, (2) most participants agreed with the helpfulness of EMI courses, (3) interactions with students of other nationalities motivated earning in EMI courses, (4) the major learning anxiety experienced by local students stemmed from self-perceived low English proficiency, (5) there existed significant reverse association between learning anxiety and learning achieve mentor learning motivation, and (6) there existed significant differences between local and international students in measures of learning motivation, learning anxiety, and learning achievement. Additionally, Tabtadze (2015) conducted research related to the factors that influenced the effectiveness of bilingual education. The result revealed that the school mostly implemented "weak" bilingual education program, the program did not have

sufficient human resources and the parents, school stakeholders and community were not active in designing and implementing this program.

Furthermore, Martine, Slate, and Garcia (2014) examined the reading and Mathematics performance of English language learner of boys and girls grades 3,4,5 and 6 as a function of early-exit and late-exit of bilingual program. Texas Assessment of Knowledge and Skills Reading and Mathematics scores of all English Language Learner boys and girls who were enrolled in both early-exit or late-exit bilingual education programs were analyzed for the 2008-2009, 2009-2010, and 2010-2011 school years. Results were not consistent across reading and Mathematics, across the four grade levels, and across the three school years. On the TAKS Reading test, five instances were present in which statistically significant differences were revealed for boys and 11 for girls. On the TAKS Mathematics test, eight statistically significant results were revealed for boys and six for girls. These statistically significant differences were not consistently in favor of either the early-exit or the late-exit bilingual education programs. Moreover, the differences that were present reflected small to trivial effect sizes. As such, neither the early-exit nor the late-exit bilingual education program was demonstrated to be more effective than its counterpart.

Methodology

Research design and respondents

This research was quantitative research using a descriptive correlational design. The correlational research design was used to answer the research objectives in order to find out the relationship between the socio-demographic characteristics and school factors with the perceived level of effectiveness on the use of English language in teaching Mathematics and Science as perceived by students and teachers. Total enumeration was used in the study, "the perceived level of effectiveness on the use of English in teaching mathematics and sciences", there were 51 respondents included 45 students were from grade 5 and 6 and six teachers from international standardized school in Indonesia. From the total of 51 respondents, only 39 students and six teachers participated in this study because five students had outside school activity so they were not around during the administration of the questionnaires. Purposive sampling was used to determine the perceived effectiveness of the use of English in teaching Mathematics and Science. The reason for choosing this sampling method because in order to find participants who were suitable for this study, for example the participants should be the students who study Mathematics and Science using English.

Research instrument

Questionnaires were given to the students and teachers in order to find out the results of research objectives on the level of effectiveness on the use of English in teaching Mathematics and Science, Questionnaires were translated into Bahasa Indonesia, their native language. This questionnaire helped to determine the perceived level of effectiveness on the use of English language in teaching Mathematics or Science as perceived by students and teachers. This questionnaire has 3 parts, Part I includes the socio-demographic

characteristics of the students and teacher such as age, sex, educational attainment of parents, language/dialect spoken, educational attainment of teacher and teacher preparation. Part II includes school factors such as facilities and equipment which was mark on a four-point scale of four (very adequate) to 1 (least adequate) and Part III includes the questions related to perceived level of effectiveness on the use of english in teaching mathematics and science as perceived by students and teachers.

These questionnaires used Likert scale items, the questionnaire requested participants to mark on a four-point scale of four (highly effective) to one (least effective) how they would rate the effectiveness of English medium instruction that they used in Mathematics and Science class. From the total 51 questionnaires for both students and teachers, only 39 questionnaires were given back to the researcher to be analyzed. The pre-test of questionnaire was conducted in a public school in Jambi which used English medium instruction. A total of 20 participants participated in this pre-test. The result showed that the questionnaire was reliable with $\alpha = .652$ with N of items as 44 greater than 0.5. The questionnaire was revised.

Data gathering procedure and analysis

The Grade 5 and Grade 6 respondents together with the six teachers were obtained from the principal to participate in this study. After the permission from the principal, the questionnaires were administered to both student and teacher respondents inside the classroom and were guided by the class adviser and also the principal. After the participants had filled up the questionnaires, the questionnaires were collected and analyzed. In analyzing the data, descriptive statistics such as frequency, percentage, mean and standard deviation were used to describe the data of the respondents' demographic background and their perception toward the perceived level effectiveness of the use of English in teaching Mathematics and Science. The Pearson-Product Moment Correlation Coefficient was used to find out the relationship between the independent and dependent variables.

Findings and Discussion

This study was conducted primarily to find out the level of effectiveness on the use of English in teaching Mathematics and Sciences at private school in Jambi, Indonesia. A total of 39 student respondents and six teacher respondents participated in the study. Questionnaire was utilized in gathering the data needed. The data were analyzed using descriptive statistics: frequency counts, percentage, mean, and standard deviation. Person-product moment correlation coefficient was employed to determine the relationship of the socio-demographic characteristics and school factors of the respondents and the level of effectiveness on the use of English in teaching mathematics and science.

Socio-demographic characteristics of teachers, students and school factors

The average age of the teacher respondents was 25-29 years old (26.6%) and the sex deliberation of teacher respondents was equal which comprised 50.00 percent male

respondents and 50.00 percent female respondents. All of the teacher respondents had bachelor's degree (100%). Majority of the teacher respondents took English course before teaching (66.7%). The average age of the student respondents was 10-12 years old (10.49%) and half of the student respondents were 10 years old (53.8%). and majority of them were males (56.4%). The majority of the parents were college graduate (64.1%) and the majority of the student respondents speak *Jambi* dialect. School factors included facility and equipment that were available in the school. Mostly both students and teachers perceived that they have adequate facilities and equipment to support the process of teaching and learning in the school with $\bar{x}$ =2.85 and $\bar{x}$ =3.50 which implies that all facilities and equipment were moderately adequate.

Respondent teacher's preparation

The result indicated that the majority of the teachers (4 or 66.7%) took English courses before teaching and two out of the 6 teachers respondents (2 or 33.3%) studied, which means that the teachers already prepare well before they teach. This finding is supported by Noell, Porter, Patt, and Dahir (2008) who found that the teachers who were trained well before teaching will perform well when they teach.

Table 1. *School factors in terms of school facilities and equipment as perceived by the teacher and student respondents*

School factors	Frequency(n=6)	Percentage
Teacher Preparation		
Took English Course	4	66.7
Study Alone	2	33.3

Table 2 presents the school factors by students and teacher respondents. This includes the school factors such as facilities and equipment that can affect the student's performance in learning Mathematics and Science using English. The result shows that the school facilities had pooled mean of x=2.85 and x=3.50. School canteen got the highest mean of x=3.26 which means that the canteen was very adequate for students and teachers to eat and spend their rest time. It also can be gleaned from the table the school equipment with the pooled mean of x =3.11 and x=3.16 indicated that all the school equipment was moderately adequate. Tables, chairs and air conditioner got the highest mean of x =3.23 and x =3.18 as perceived by students and chairs and air conditioner got a highest mean of x =3.67 as perceived by the teachers, that indicated the school has very adequate tables and chairs and also air conditioner to study.

Table 2. *School factors in terms of school facilities and equipment as perceived by the teacher and student respondents*

School Factors	Respondents					
	Students n=39			Teachers n=6		
	Mean	SD	D	Mean	SD	D
Facilities	2.85	.604	MA	3.50	.836	VA
1. Speech laboratory	2.56	1.14	MA	3.00	.632	MA
2. School canteen	3.26	.751	VA	3.33	.816	VA
3. Classroom	2.85	.812	MA	3.00	.632	MA
4. Auditorium	3.05	.793	MA	3.33	.816	VA
5. Gymnasium	2.85	.904	MA	3.00	.632	MA
6. Library	3.15	.961	MA	3.17	1.16	MA
7. School clinic	2.74	.938	MA	2.67	1.03	MA
8. Parking area	2.87	.978	MA	2.67	1.03	MA
9. Printing shop	2.82	1.04	MA	3.00	.632	MA
10. Internet shop	2.85	.605	MA	2.83	.983	MA
Equipment	3.11	.739	MA	3.16	.408	MA
11. White board	3.21	.767	MA	3.17	.753	MA
12. Air conditioner	3.18	.914	MA	3.67	.516	VA
13. Board markers	2.97	.932	MA	3.50	.548	VA
14. Projectors	3.08	.984	MA	3.50	.837	VA
15. Tables	3.23	.959	MA	3.50	.548	VA
16. Chairs	3.23	1.01	MA	3.67	.516	VA
17. Lighting	2.90	1.07	MA	3.21	.653	MA

Legend: 3.26 – 4.00 = Very Adequate (VA)
2.51 – 3.25 = Moderately Adequate (MA)
1.76 – 2.50 = Adequate (A)
1.00 – 1.75 = Not Adequate (NA)

Perceived level of effectiveness on the use of English in teaching mathematics and science as perceived by students

Perceived level of effectiveness on the use of English in teaching Mathematics and Science perceived by students shown in Table 3 with the pooled computed mean of x =2.91, verbally described as "moderately effective" and a standard deviation of .459. The items which earned the highest weighted mean was "English Medium Instruction help me to improve my English reading and writing ability" (x =3.38), followed by "I understand more when my teachers explain it in *Bahasa* rather than in English" (x=3.33). These items earned a descriptive rating of "highly effective". This may mean that the students who learn Mathematics and Science in English help them to improve their English especially in reading, writing, listening and speaking which means that the students can read and write better in English" and this result conformed the study done by Rogier (2012) who found out the students of English medium instruction class improved their speaking, writing and reading ability and also some

students perceived that they will understand Mathematics and Science more if the teachers use *Bahasa Indonesia*.

Table 3. *Perceived level of effectiveness on the use of English language in teaching mathematics and science as perceived by students*

Parameter	Mean	SD	Description
I enjoy all the lessons delivered in the English language only	3.03	0.77	Moderately Effective
In the classroom, my teachers always use English	3.10	0.91	Moderately Effective
I feel that my Bilingual Education experience is effective in helping me learn English.	3.18	0.68	Moderately Effective
I would have succeeded academically without the support of the Bilingual Education program.	2.36	0.95	Effective
I understand math and science well when my teachers explain it in English	3.00	0.94	Moderately Effective
I find English-medium instruction (EMI) useful	3.10	0.88	Moderately Effective
I understand more when my teachers explain it in *Bahasa* rather than in English	3.33	0.80	Highly Effective
I got new vocabularies every time my teacher used English in classroom	3.18	0.91	Moderately Effective
I can respond directly when my teachers ask question in English	2.85	0.96	Moderately Effective
I can understand directly when my teachers give instructions in English	2.87	0.89	Moderately Effective
Using English in Math and Science is difficult for me	2.54	1.14	Moderately Effective
English Medium Instruction help me to improve my English listening and speaking ability	3.31	0.97	Highly Effective
English Medium Instruction help me to improve my English reading and writing ability	3.38	0.87	Highly Effective
It hard for me to understand math and sciences instructions in English	2.69	1.03	Moderately Effective
English instruction Medium help me to understand all the math and sciences book that written in English	3.00	0.91	Moderately Effective
I do not have self-confident to participate in class when they use English	2.13	1.03	Effective
English medium instruction motivate me to study English more	3.08	1.06	Moderately Effective
I can easily understand some instructions in English book	3.08	0.90	Moderately Effective
English medium instruction improve my English	3.26	0.91	Highly Effective
I talk to my friends using English in classroom	2.56	0.91	Moderately Effective
I feel anxious when I cannot understand some instruction	2.72	1.02	Moderately

in English			Effective
I can understand easily when the mathematics and sciences exam written in English	2.69	0.97	Moderately Effective
I ask the classmates for help when I encounter difficulty in the full-English course	2.54	1.02	Moderately Effective
English medium instruction is easy and helpful for me	2.97	1.13	Moderately Effective
POOLED MEAN	2.91	.459	Moderately Effective

Legend: 3.26 – 4.00 = Highly Effective
2.51 – 3.25 = Moderately Effective
1.76 – 2.50 = Effective
1.00 – 1.75 = Least Effective

Perceived level of effectiveness on the use of English in teaching mathematics and science as perceived by teachers

Perceived level of effectiveness on the use of English in teaching mathematics and science perceived by students shown in Table 4 with the pooled computed mean of x=2.75, verbally described as "moderately effective" and a standard deviation of .440. The item which earned the highest weighted mean was "I find English-medium instruction (EMI) useful" (x=3.50) and followed by the items "Teachers have appropriate skills of English to Teach in EMI." (x=3.33). These two items earned a descriptive rating of "highly effective."

Table 4. *Perceived level of effectiveness on the use of English language in teaching Mathematics and Science as perceived by teachers*

Parameter	Mean	SD	Description
I find English-medium instruction (EMI) useful	3.50	.548	Highly Effective
EMI increase the employability chances of students.	2.83	.983	Moderately Effective
Teachers have appropriate skills of English to Teach in EMI.	3.33	.516	Highly Effective
Teachers have problems teaching in EMI	3.00	.632	Moderately Effective
I explain in *Bahasa* when I have problem explaining concepts in English.	2.50	.837	Effective
My Students do not understand when I explain in English	2.50	.837	Effective
Students have problem understanding concepts of mathematics in EMI.	2.83	.408	Moderately Effective
Students have problem understanding concepts of Science in EMI.	2.67	.516	Moderately Effective
Students will have better understanding of mathematics in *Bahasa.*	3.00	.000	Moderately Effective
Students will have better understanding of Science in *Bahasa.*	2.67	.516	Moderately Effective
If science and Mathematics subjects are studied in English, the students can learn the language of science	2.83	.753	Moderately Effective

and technology			
EMI has a negative effect on the efficiency of science and mathematics instruction	2.33	.516	Effective
EMI will have an adverse effect on student achievement in science and mathematics subjects.	2.83	.753	Moderately Effective
The difficulty I encounter in EMI is my low English proficiency	2.17	.753	Effective
I feel anxious every time I do not know the meaning of the instruction in the textbook	2.83	.753	Moderately Effective
I always find out the meaning of the instructions before I enter the classroom	2.17	.753	Effective
Teaching mathematics and science in English help me to improve my English language skill	2.67	.516	Moderately Effective
I have difficulty every time I explain the subjects in English	2.83	.753	Moderately Effective
My students will not respond directly if I use full English without any translation	2.67	.816	Moderately Effective
My students participate actively in the classroom using English	2.67	.816	Moderately Effective
I think non-English-speaking students should be taught basic subjects in their own language while they learn English.	2.67	.816	Moderately Effective
I prefer to teach in *Bahasa* rather than in English	2.76	.440	Moderately Effective
POOLED MEAN	**2.75**	**.440**	Moderately Effective

Legend: 3.26 – 4.00 = Highly Effective
2.51 – 3.25 = Moderately Effective
1.76 – 2.50 = Effective
1.00 – 1.75 = Least Effective

Relationship between students' socio-demographic characteristics and perceived level of effectiveness on the use of English in teaching mathematics and science

Age was found to a have significant relationship with a perceived level of the effectiveness on the use of English in teaching mathematics and science in two items, "I understand mathematics and science well when my teachers explain it in English" (r=.350) and I can easily understand some instructions in English book" (r=.344). The findings most likely suggest that the students understand more if the textbook is written in English and when the teacher teaches mathematics and science in English. This finding negated the study of Kiwanuka et al. (2015), where they found that the mean scores in Mathematics of younger students in senior two (grade eight) were higher than those of their older counterparts within the same class.

Sex was found to have a significant but negative relationship with a perceived level of effectiveness on the use of English in teaching mathematics and science in one item, "It is hard for me to understand mathematics and sciences instructions in English" (r=.381) which

implies that the students who are females tend to have a hard time to understand mathematics and science when the teachers teach using English. This study confirms the study of Skaalvik and Skaalvik (2004) who found that boys performed well than girls in mathematics. Language/dialect spoken was found to have a significant relationship with a perceived level of the effectiveness on the use of English in teaching mathematics and science in one item "I enjoy all the lessons delivered in the English language only" (r=.328). The finding may mean that the students who speak *Jambi* dialect tend to enjoy the lesson if the teachers used English only without mixing it with their first language or their dialect.

Table 5. *Relationship between student socio-demographic characteristics and perceived level of effectiveness on the use of English language in teaching Mathematics and Science as perceived by the students*

Student Profile	Age	Sex	Educational Attainment of Parents	Lang. Spoken
Perceived Level of Effectiveness on the use of English language in teaching Mathematics and Science				
I enjoy all the lessons delivered in the English language only	-.091	-.036	.021	**.328***
In the classroom, my teachers always use English	-.101	-.009	.070	-.093
I feel that my Bilingual Education experience is effective in helping me learn English.	-.167	-.059	-.054	-.157
I would have succeeded academically without the support of the Bilingual Education program.	.157	-.247	.203	-.039
I understand mathematics and science well when my teachers explain it in English	**.350***	-.275	.189	.121
I find English-medium instruction (EMI) useful	.056	-.186	.309	.134
I understand more when my teachers explain it in *Bahasa* rather than in English	.274	-.194	.000	-.126
I got new vocabularies every time my teacher used English in classroom	.082	.184	-.138	.063
I can respond directly when my teachers ask question in English	.045	-.096	-.007	-.046
I can understand directly when my teachers give instructions in English	.288	-.135	.077	.023
Using English in Mathematics and Science is difficult for me	-.092	-.287	-.278	.085
English Medium Instruction help me to improve my English listening and speaking ability	.153	.082	.105	-.001

English Medium Instruction help me to improve my English reading and writing ability	.091	-.005	-.167	-.230
English instruction Medium help me to understand all the mathematics and sciences book that written in English	.155	.000	.260	.069
English Medium Instructions help to improve my achievement in mathematics and Sciences because I easily understand it	.197	.090	.125	.077
I do not have self-confident to participate in class when they use English	-.112	-.086	-.298	.066
I find English-medium instruction (EMI) useful	.056	-.186	.309	.134
English medium instruction motivate me to study English more	.113	.166	045	-.153
I can easily understand some instructions in English book	**.344***	-.209	-.013	.116
English medium instruction improve my English	.215	.035	-.151	-.227
I talk to my friends using English in classroom	.222	-.163	-.136	-.186
I feel anxious when I cannot understand some instruction in English	.063	.004	.148	.238
I ask the classmates for help when I encounter difficulty in the full-English course	.267	-.118	-.195	-.229
English medium instruction is easy and helpful for me	.271	.117	.169	.156

Legend: *significant (p<.05)

Relationship between teachers' socio-demographic characteristics and perceived level of effectiveness on the use of English in teaching mathematics and science

As shown in Table 6, there was no significant relationship between teachers' socio-demographic characteristics and perceived level of effectiveness on the use of English in teaching mathematics and science. This finding may mean that whether the teachers young or old, male or female, certified teacher or not, college graduate or not, speak *Jambi* dialect or not and had enough preparation or not, there was no relationship with the level of the effectiveness on the use of English in teaching mathematics and science. The hypothesis stating that teachers' profile has no significant relationship with perceived level of effectiveness on the use of English in teaching Mathematics and Science was accepted. This study negated the result of the studies done by Noell, Porter, Patt, and Dahir (2008) that certified teachers perform well in teaching and Kainuwa and Yusuf (2013) that the children who have parents with higher educational attainment perform well in the classroom.

Table 6. *Relationship between teacher socio-demographic characteristics and perceived level of effectiveness on the use of English language in teaching Mathematics and Science as perceived by the teachers*

Teachers Profile	Age	Sex	Field of Specialization	Lang. Spoken	Teacher Pre.
Perceived Level of Effectiveness on the use of English language in teaching Mathematics and Science					
I find English-medium instruction (EMI) useful	.333	.535	-.333	.124	-.707
EMI increase the employability chances of students.	-.557	-.645	.186	-.530	.131
Teachers have appropriate skills of English to Teach in EMI.	-.707	-.094	.000	-.351	-.500
Teachers have problems teaching in EMI	.000	.231	-.577	.215	.000
I explain in *Bahasa* when I have problem explaining concepts in English.	-.218	.000	.218	.568	-.463
My Students do not understand when I explain in English	.218	.175	-.218	.568	.000
Students have problem understanding concepts of mathematics in EMI.	.447	.239	-.447	.388	.316
Students have problem understanding concepts of Science in EMI.	-.707	-.756	.707	-.175	-.250
Students will have better understanding of Mathematics in *Bahasa.*	-	-	-	-	-
Students will have better understanding of Science in *Bahasa.*	-.707	-.756	.707	-.175	-.250
EMI has a negative effect on the efficiency of science and mathematics instruction	.000	-.094	.000	.439	-.500
EMI will have an adverse effect on student achievement in science and mathematics subjects.	-.243	-.065	-.243	-.150	-.343
The difficulty I encounter in EMI is my low English proficiency	-.243	-.130	.243	.511	-.686
I feel anxious every time I do not know the meaning of the instruction in the textbook	-.243	-.065	-.243	-.150	-.343
Teaching mathematics and science in English help me to improve my English language skill	.707	.661	-.707	.614	-.250
I have difficulty every time I explain the subjects in English	.243	.519	-.728	.391	-.343

My students will not respond directly if I use full English without any translation	.000	.418	-.447	.555	-.632
My students participate actively in the classroom using English	.000	.418	-.447	.555	-.632
I think non-English-speaking students should be taught basic subjects in their own language while they learn English.	.000	.418	-.447	.555	-.632
I prefer to teach in *Bahasa* rather than in English	-.228	.065	-.228	.312	-.534

Note: Effectiveness Number 9 and Highest Educational Attainment got the same answers from the respondents; therefore, correlation cannot be computed

Relationship between school factors and the perceived level of effectiveness on the use of English in teaching mathematics and science perceived by the students

School facilities and equipment were found to have a highly significant relationship with the level of the effectiveness on the use of English in teaching mathematics and science in statement, "I enjoy all the lessons delivered in the English language only" (r=.461 and r=.498). This finding may mean that the better school facilities and school equipment that the school has the more effective and enjoyable are the lessons in class, especially for mathematics and science when using English language only.

School equipment was found to have a significant relationship with the level of effectiveness on the use of English in teaching Mathematics and Science in statement, "I feel that my Bilingual Education experience is effective in helping me learn English" (r=.316) which implies that if the school have adequate equipment to teach, it will help the students who had bilingual education experience more effective in learning mathematics and science especially using English medium instruction.

School facilities were found to have highly significant relationship with the level of the effectiveness on the use of English in teaching mathematics and science in statement, "I understand mathematics and science well when my teachers explain it in English" (r=.432). This finding may mean that adequate school facilities available in the school help the students to understand the explanation from the teachers in mathematics and science using English. On the other hand, school facilities were also found to have significant relationship in three statements, "I find English-medium instruction (EMI) useful" (r=.404), "English Medium Instructions help to improve my achievement in mathematics and Sciences because I easily understand it" (r=.328) and "I can understand easily when the mathematics and sciences exam written in English" (r=.323). The hypothesis stating that school factors have no significant relationship with the perceived level of effectiveness on the use of English in teaching mathematics and science perceived by students was rejected. This finding negated the study of McGowen (2007) where facility adequacy was not directly related to student performance.

Table 7. *Relationship between school factors and perceived level of effectiveness on the use of English language in teaching Mathematics and Science as perceived by the students*

School Factor	Facilities	Classroom Equipment
Perceived Level of Effectiveness on the use of English language in teaching Mathematics and Science		
I enjoy all the lessons delivered in the English language only	.461**	.498**
In the classroom, my teachers always use English	.314	.126
I feel that my Bilingual Education experience is effective in helping me learn English.	.243	.316*
I would have succeeded academically without the support of the Bilingual Education program.	.211	.083
I understand mathematics and science well when my teachers explain it in English	.432**	.172
I find English-medium instruction (EMI) useful	.404*	.269
I understand more when my teachers explain it in *Bahasa* rather than in English	.092	.149
I got new vocabularies every time my teacher used English in classroom	.263	.225
I can respond directly when my teachers ask question in English	-.026	-.081
Perceived Level of Effectiveness on the use of English language in teaching Mathematics and Science		
I can understand directly when my teachers give instructions in English	.184	.187
Using English in Mathematics and Science is difficult for me	.166	.045
It hard for me to understand mathematics and sciences instructions in English	.188	.042
English instruction Medium help me to understand all the mathematics and sciences book that written in English	.266	.127
English Medium Instructions help to improve my achievement in mathematics and Sciences because I easily understand it	.328*	.182
I do not have self-confident to participate in class when they use English	.086	.198
English medium instruction motivate me to study English more	.219	.271
I can easily understand some instructions in English book	.181	.008
English medium instruction improve my English	.041	.072
I talk to my friends using English in classroom	.120	-.065
I feel anxious when I cannot understand some instruction in English	.131	.192
I can understand easily when the mathematics and sciences exam written in English	.323*	.148
I ask the classmates for help when I encounter difficulty in the full-English course	.058	.216
English medium instruction is easy and helpful for me	.286	.281

Legend: *significant ($p<05$)
**highly significant ($p<01$)

Relationship between school factors and the perceived level of effectiveness on the use of English in teaching mathematics and science perceived by the teachers

School facilities were found to have a significant negative relationship in three statements, "My students will not respond directly if I use full English without any translation" (r=-.878), "My students participate actively in the classroom using English" (r=-.878) and "I think non-English-speaking students should be taught basic subjects in their own language while they learn English" (r=-.878) which means that these statements were related to classroom activity such as a conversational activity so both students and teachers do not need facilities. They just need the discussion on several topics in Mathematics and Science subjects and the fewer students; the more they are engaged to the discussion. Furthermore, the teachers sometimes used *Bahasa* Indonesia in the classroom. The hypothesis stating that school factors have no significant relationship with the level of effectiveness on the use of English in teaching mathematics and science perceived by students was rejected. This finding negated the study of McGowen (2007) that facility adequacy was not directly related to student performance.

Table 8. *Relationship between school factors and perceived level of effectiveness on the use of English language in teaching mathematics and science as perceived by the teachers*

School Factor	Facilities	Classroom Equipment
Perceived Level Effectiveness on the use of English language in teaching Mathematics and Science		
I find English-medium instruction (EMI) useful	-.655	.447
EMI increase the employability chances of students.	-.122	.581
Teachers have appropriate skills of English to Teach in EMI.	-.463	.632
Teachers have problems teaching in EMI	-.756	.775
I explain in *Bahasa* when I have problem explaining concepts in English.	-.429	.293
My Students do not understand when I explain in English	-.429	.293
Students have problem understanding concepts of mathematics in EMI.	-.293	.200
Students have problem understanding concepts of Science in EMI.	.000	.316
Students will have better understanding of Mathematics in *Bahasa.*	-	-
Students will have better understanding of Science in *Bahasa.*	.000	.316
If science and Mathematics subjects are studied in English, the students can learn the language of science and technology	-.476	.759
EMI has a negative effect on the efficiency of science and mathematics instruction	-.463	.632

EMI will have an adverse effect on student achievement in science and mathematics subjects.	-.476	.759
The difficulty I encounter in EMI is my low English proficiency	-.476	.542
I feel anxious every time I do not know the meaning of the instruction in the textbook	-.476	.759
My students will not respond directly if I use full English without any translation	**-.878***	.800
My students participate actively in the classroom using English	**-.878***	.800
I think non-English-speaking students should be taught basic subjects in their own language while they learn English.	**-.878***	.800
I prefer to teach in *Bahasa* rather than in English	-.769	**.881***

Legend: *significant (p<.05)
Note: Effectiveness Number 9 got the same answers from the respondents; therefore, correlation cannot be computed

Conclusions and Recommendations

Based on the results of this study, the following conclusions were drawn. Majority of the student respondents were males. Their age ranged from 10-12 years old. Majority of their parent were college degree holders and some were secondary education graduates. Most of them speak *Jambi* dialect. Teacher respondents were equal in sex distribution with three males and three females. Their age ranged from 25-29 years old. Majority of their teacher were college degree holders. Most of them speak *Jambi* dialect and the majority of the teacher respondents took English course before teaching mathematics and science using English medium instruction.

Both student and teacher respondents perceived that they have adequate facilities in their school to facilitate their teaching and learning activities. English Medium Instruction was perceived to be highly effective in helping the students to improve their achievement in mathematics and science and also their English language skills especially in reading and writing. English as medium instruction was perceived to be highly effective for the teachers because they found it useful for both the teachers and students and also the teachers need to have appropriate skills to teach using English medium.

Age, sex, and language spoken have significant relationship with perceived level of effectiveness on the use of English in teaching mathematics and science. There was no significant relationship between teachers' socio-demographic characteristics and the perceived level of effectiveness on the use of English in teaching mathematics and science. There was a highly significant relationship between school factors and the perceived level of effectiveness on the use of English in teaching mathematics and science as perceived by the students in term of facilities and equipment. This relationship suggested that the school should have adequate facilities and equipment to support teaching and learning activity, so it will help the students to learn, like tape recorder or listening laboratory to help the students to improve their listening skill. There was a significant negative relationship between school factors and the perceived level of effectiveness on the use of English in teaching mathematics and science as perceived by the teachers in term of facilities and equipment.

This relationship suggested that the fewer facilities and equipment that were used, the more engaged were the students in classroom discussion.

In the light of the results and conclusions of this study, the following measures are strongly recommended. Teachers should continue to use English language in classroom to help the students improve both their achievement in mathematics and science and also their English language skill. Students should be given all the chances to learn and develop their English language skill and also their performance in mathematics especially for female students. Gender issue as it relates to achievement in mathematics and science should also be given attention. The teachers should give a chance to students to participate in classroom discussion, so they can improve their speaking skill.

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References

Altbach, P. G., & Knight, J. (2007). The internationalization of higher education: Motivations and realities. *Journal of Studies in International Education, 11*(3-4), 290-305.

Ayotola, A., & Adedeji T. (2009). The relationship between gender, age, mental ability, anxiety, mathematics self- efficacy and achievement in mathematics. *Cypriot Journal of Educational Sciences, 4*(2), 113-124.

Buddin, R., & Zamarro, G. (2009). Teachers qualifications and student achievement in urban elementary schools. *Journal of Urban Economics, Elsevier, 66*(2), 103-115.

Byun, K., Chu, H., Kim, M., Park, I., Kim, S., & Jung, J. (2011). English-medium teaching in Korean higher education: policy debates and reality. *Higher Education, 62*(4), 431–449.

Cho, J., & Holditch-Davis, D. (2014). Effects of perinatal testosterone on infant health, mother-infant interactions, and infant development. *Biological Research for Nursing, 16*(2), 228–236.

Darling-Hammond, L., Holtzman, D., Gatlin, S., & Vasquez Heilig, J. (2005). Does teacher preparation matter? evidence about teacher certification, teach for America, and teacher effectiveness. *Education policy analysis archives, 13*, 42. doi:https://doi.org/10.14507/epaa.v13n42.2005

Demski, J. (2011). It's a family affair. *The Journal, 38*(3), 22-28.

Huang, D. F. (2015). Exploring and assessing effectiveness of English medium instruction courses: The students' perspectives. *Social and Behavior Science Journal*, *173*, 71-78.

Humlum, M. (2011). Timing of family income, borrowing constraints, and child achievement. *Journal of Population Economics, 24*(3), 979-1004. doi:10.1007/s00148-010-0309-9.

Jensen, E. (2013). How poverty affects classroom engagement. *Educational Leadership, 70*(8), 24-30.

Kainuwa, A., & Yusuf, N. B. M. (2013). Influence of socio-economic and educational background of parents on their children's education in Nigeria. *International Journal of Scientific and Research Publications*, *3*(10), 1-8.

Kiwanuka, H. N., Damme, J. V., Noortgate, W.V. D., Anumendem, D. N., & Namusisi, S. (2015). Factors affecting mathematics achievement of first-year secondary school students in central Uganda. *South African journal education, 35*(3), 1-16.

Lovas, G. S. (2011). Gender and patterns of language development in mother-toddler and father-toddler dyads. *First Language, 31*(1), 83–108.

Majhanovich, S. (2014). Neo-liberalism, globalization, language policy and practice issues in the Asia-Pacific Region. *Asia-Pacific Journal of Education, 34*(2), 168- 183.

Margana. (2015). Establishing English-Indonesian bilinguals in Indonesia: from theory to practice. *RA Journal of Applied Research, 1*(10), 365-374.

Martinez, H., Slate, J. R., & Garcia, C. M. (2014). English language learner boys and girls reading and mathematics achievement as a function of early-exit and late-exit bilingual programs: A multiyear, statewide analysis. *Education Research International*, 1-9. http://dx.doi.org/10.1155/2014/508459

McGowen, R. S. (2007): *The impact of school facilities on student achievement, attendance, behavior, completion rate and teacher turnover rate in selected Texas high schools* (Unpublished Doctoral Dissertation). Texas: A&M University.

Noell, G. H., Porter, B. A., Patt, R. M., & Dahir, A. (2008.) *Value added assessment of teacher preparation in Louisiana: 2004-2005 to 2006-2007*. Report to the Louisiana Department of Education: Louisiana State University, Department of Psychology.

Northwestern University. (2008). Boys' and girls' brains are different: Gender differences in language appear biological. *Science Daily*. Retrieved from http://www.sciencedaily.com/releases/2008/03/080303120346

Nor, F.M., Aziz, M.A., & Jusoff, K. (2011). Should English for teaching mathematics and sciences (etems) in Malaysia be abolished? *World applied sciences journal*, 36-40.

Rogier, D. (2012). *The effects of English-medium instruction on language proficiency of students enrolled in higher education in the UAE* (Unpublished Master Thesis). UK: University of Exeter.

Skaalvik, S., & Skaalvik, E. M. (2004). Gender differences in mathematics and verbal self-concept, performance expectations, and motivation. *Sex Roles, 50*(3–4), 241–252.

Tabatadze, S. (2015). Factors influencing the effectiveness of bilingual educational programs: The prospects of pilot programs in Georgia. *Sino-US English Teaching, 12*(9), 93-109.

Wilkinson, R. (2013). English-medium instruction at a Dutch university: Challenges and pitfalls. In A. Doiz, D. Lasagabaster and J. M. Sierra (Eds.), *English-medium Instruction at Universities: Global Challenges* (pp. 3-24). Bristol: Multilingual Matters.

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