
THE APPLICATION OF BILINGUAL METHOD IN SCIENCE TEACHING: A STUDY CASE AT SMA MUHAMMADIYAH 2 YOGYAKARTA

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Abstract

This is a study on how bilingual method in science teaching was implemented in senior high school level in Indonesia. The study was been set up in science classes at SMA Muhammadiyah 2 Yogyakarta which involving science teachers in Math, Biology and Physics. It is conducted during the bilingual system was adopted by Indonesian government. Since the findings are very useful to evaluate the benefits of the system, the writers come to decision to publish this research. It shows how the implementation depends much on the linguistic competence of the science teachers and that the model of bilingual education tends to be additive than to be subtractive.

Key words: bilingual education, SMA Muhammadiyah 2 Yogyakarta

A. INTRODUCTION

The teaching and learning of another language other than the medium of instruction are normally practiced by schools in the countries that implement the bilingual education. Bilingual education generally imply to education where two different languages are used for general teaching. The bilingual teaching as an important teaching methodology is the purposes of making students to grasp professional knowledge and skill, and enhancing the students' ability of English application and of cultivating talents with high quality for education reforms in the university. Some of the aims of bilingual education are to uphold the language rights, maintain the cultural values, upgrade the educational attainment and reduce school-dropouts of the diverse population. However, the bilingual teaching has still been a controversy. The controversy about bilingual education centers around the role of L1 instruction: Should English language learners (ELLs) receive instruction in English-only? Should they receive instruction in their L1 until they are able to comprehend English? Or should the schools continue to develop the ELLs' L1 skills even after they have become proficient English speakers? Or, how well do these bilinguals know their first and second languages? How well can they speak, understand, read, and write in their two languages?

In Indonesia, bilingual education has been taking place in many schools since the government has decided to make a national policy to develop pioneer schools based upon international standard curriculum. Considering that the policy has been running for almost five years, it is interesting to explore the field implementation of the bilingual method. Since the characteristics of Indonesian students are very different with USA or European countries pupils, we can make sure that the bilingual models in Indonesia and other Asian countries are different with the ones in the US and European countries. In the United States or European countries, the classrooms consist of many bilingual students since there are many immigrants from different race or nations. Bilingual education is generally perceived as a means to empower minority students by acknowledging their home language and culture and using it to help them construct their learning.

A brief illustration on how the bilingual system was implemented Indonesia has been given below (Margana, 2013: 772)

The implementation of the bilingual education in Indonesia started in 2004 and gained its popularity for about 8 years establishing 1300 schools categorized as international standardized schools in 2012. Since 2011 the bilingual education program have been criticized by some parties which argue that such a program has discriminated the poor from the rich as those international standardized schools are mostly enjoyed by the rich rather than the poor. This means that a great number of students of those schools are from the rich family. Added to

this, the bilingual class students are exclusively treated in terms of school facilities, academic issues compared to non-bilingual class students. This drives some opponent parties to take the case into judicial review of the Act of the Indonesian Republic Number 20 Year 2003 Article 50 Verse 3 about the implementation of the bilingual class program. With regard to this issue, the Judicial Court in Indonesian called "Makamah Konstitusi" came to the agreement that the bilingual class program has to be eradicated on the grounds that it violates the basic laws of Indonesian Republic Year 1945. In other words, the bilingual class program has been banned to be carried out since January 2013. To counter the decision of the Judicial Court, some headmasters of the bilingual schools state that the bilingual class program is beneficial for students to face the global challenges.

During the implementation, delivering English-medium instruction in science classrooms was a continuing challenge in Indonesian urban areas and frightening in rural. At the same time, most majority students were not fluent in foreign language like English. Students who learn science studies in a language other than their mother tongue usually have problems of language. Many experts have warned that academic achievement is generally not easy for students learning through their native language because of the highly specialized terms with a variation of meanings from those used in every day speech. It is more so difficult for L2 learners because they have to first struggle with the English language and thereafter with the academic language. Science has many abstracts languages and English language is not easy to master either. Students have to struggle with learning new concepts and content in science while at the same time trying to understand the content in English. Thus, the teaching of science in English will definitely cause many difficulties to the students and teachers alike in Asian countries especially Indonesia.

By declaring bilingual method as teaching approach in the international (target) classes, science teachers must have challenge in developing Cognitive Academic Language Proficiency (CALP) in second language. Bilingual education teaches English to children and gives them a chance to use it, and at the same time they are taught core subjects like math and science. In addition, a bilingual teacher may face opportunities and constraints in implementing what they believe enhance bilingual children's opportunities for learning. In addition to all the provisos placed on generalized teachers, bilingual teachers also face a double linguistic demand in the bilingual classroom. Although a supportive working environment that promotes dual language is of great importance, bilingual teachers also need to feel that they can control the type of instruction provided for their students.

The literature suggests the importance of the following variables: (a) which language of instruction is used, and for what content; (b) how the first and second languages may be used together; (c) how students are physically grouped for instruction, (d) what types of learning activities occur, and with what opportunity for student language use, and (e) how listening, speaking, writing and reading communication modes are utilized for language learning. However, due to the limited time to run this research and the limited capability of the writer, then the writer finally focuses to observe the application of Bilingual/ESL teaching strategies and methods embodied in the classroom procedures of the science teachers in SMA Muhammadiyah 2 Yogyakarta.

The general research questions guiding this inquiry are: 1) What kind of bilingual teaching method has been implemented in SMA Muhammadiyah 2 Yogyakarta? 2) What teaching procedures or instructional strategies are applied in teaching science with bilingual method by science teachers in SMA Muhammadiyah 2 Yogyakarta?

B. THEORETICAL REVIEW

The discussion of bilingual education can come from two different perspectives: (a) *Additive bilingualism* focuses on learning English while preserving use of the mother tongue, and (b) *subtractive bilingualism* focuses on teaching English to replace the mother tongue. Some types of bilingual education promote *additive bilingualism*. In additive bilingualism students come into school speaking their mother tongue and a second language is added. The result is clearly an individual who is bilingual. Other types of bilingual education, however, are involved in *subtractive bilingualism*. In situation of subtractive bilingualism, students are instructed in both their mother tongue and a second language (Garcia, 1996). Eventually, however, instruction in the mother tongue ceases, with the second language becoming the sole medium of instruction and ultimately the only language of the student (Lambert, 1980).

Educational programs that support additive bilingualism are also referred to as *strong*, whereas those which engage on subtractive bilingualism are indicated to as *weak* (Baker, 1993). Whether bilingual education promotes additive or subtractive forms of bilingualism is related to the reasons why the educational system uses the two languages. Often, bilingual education for the language majority promotes additive bilingualism, whereas that for the language minority develops subtractive bilingualism.

Research has shown significant benefits in supporting additive bilingualism: (1) *social advantages*: Bilingual children mature earlier, are more comfortable with diversity, exhibit social adaptability, and identify more with their ethnic group, (2) *personal advantages*: Bilingual children are able to maintain their pride in heritage and their connection in family relationship, and to enhance self-esteem and identity, and (3) *cognitive advantages*: Bilingual individuals show higher divergent thinking and increased social sensitivity in situations requiring verbal communication. They also demonstrate clearer thinking and analytical functioning (Mackey, A., Abbuhl, R, 2008).

Bilingual programs count on the primary language to teach academic subjects while students are studying English. They enlarge the student's primary language skills, but vary in the emphasis placed on teaching students to read and write in their primary language. Primary language-based programs provide full access to core content instruction in mathematics, science, social studies, and language arts. In study schools using the primary language, students were provided instruction at grade level without the barriers posed by limited English fluency.

Qualified bilingual teachers apply appropriate mathematical and scientific vocabulary in the primary languages in mathematics and science classes. In schools where study observers were able to observe mathematics and science lessons taught by the same teacher in both the primary language and using sheltered techniques, the level of discourse, richness of language, and cognitive development of students was more advanced in primary language classes. The bilingual programs vary in how long the native language is used for instruction. In general, bilingual education goals include teaching English, fostering academic achievement, assisting immigrants acculturation to a new society, preserving a minority group's linguistic and cultural heritage, enabling English speakers to learn a second language, developing national language resources, or any combination of the above. However, since bilingual education takes many different forms, with each emphasizing different goals and priorities, it is useful to review them. The research literature identifies several types of programs that fall within the category of bilingual education but have different goals: (a) *transitional or early-exit programs* that provide L1 instruction in subject-matter studies while the students are acquiring English; (b) *two-way bilingual education programs*, which allow ELLs and fluent English speakers to learn English and another language; and (c) *late-exit programs* that emphasize full bilingualism (i.e., the ability to speak, read, and write proficiently in two languages) and academic learning for ELLs. In contrast, the English-only submersion, or "sink or swim," approach does not provide ELLs with any special help in overcoming language barriers that hamper students in learning content. While English-only programs may facilitate the acquisition of conversational English at a faster rate than bilingual programs, only transitional, late-exit, and two way programs support the acquisition of academic English (Krashen, 1996).

It is critical to integrate language and content for the following reasons: students learn a second language more successfully when instruction includes social and academic language in each lesson (Collier, 1995), students can learn language and academic content simultaneously through meaningful academic content (Collier, 1995), studying English in isolation without learning grade-level concepts can delay a LEP student's academic progress, native speakers of English have not stopped learning content as their LEP counterparts catch up (Collier, 1995; Ovando & Collier; 1998).

Educational and linguistic theorists suggest that students may become quite proficient in the grammar, vocabulary and sentence structure of the English language, but may lack the necessary cognitive academic language proficiency to learn the subject matter that is presented to them in science classrooms (Cummins, 1980). In other words, these students may be proficient in their English communication skills but may not have the cognitive academic language proficiency (CALP) required for learning science or other academic subject matter. Content-based ESL is a method that integrates English-as-a-second-language instruction with subject matter instruction. The technique focuses not only on learning a second language, but

also on using that language as a medium to learn mathematics, science, social studies, or other academic subjects. One of the reasons for the increasing interest among educators in developing content-based language instruction is the theory that language acquisition is based on input that is meaningful and understandable to the learner (Krashen, 1982).

C. RESEARCH SETTING AND SUBJECTS

The setting for this study is SMA Muhammadiyah 2 Yogyakarta that located on 7th Jalan Kapas, Yogyakarta City. There are two main reasons why the researcher took this institution for investigation: first, SMA Muhammadiyah 2 Yogyakarta has been selected by National Education Ministry as one of the pioneer school in Indonesia that based on the international standard curriculum since 2006. Since then, SMA Muhammadiyah 2 Yogyakarta has opened up 4 (four) international classes with 137 pupils and 12 science teachers and been accredited A by National Accreditation Body with its score is 97, 69 (Pedoman Penyelenggaraan Rintisan SMA Bertaraf Internasional SMA Muhammadiyah 2 Yogyakarta Tahun Ajaran 2005/ 2011). Second, the researcher has an experience in giving English tutorial for Muha English Debating Club, an extracurricular club in SMA Muhammadiyah 2 Yogyakarta, so that the researcher feels more familiar with the research respondents.

In order to improve the students understanding on the different disciplines of science, SMA Muhammadiyah 2 Yogyakarta embarked on modular teaching, where three different teachers specialized in the areas of physics, chemistry and biology, teach their respective disciplines to the secondary classes. It was declared in the Principal Decree (SK Kepala Sekolah) of SMA Muhammadiyah 2 Yogyakarta No.E-2/ 0623/ a.12/ VII/ 2008 that there were 10 science teachers in regular classes: 4 biology ones, 3 physics ones and 3 chemistry ones.

Table 1
Science Teachers of SMA Muhammadiyah 2 Yogyakarta
in Regular Classes for Academic Year 2008/ 2009

No	Lesson	Teacher's Name	Gender	Class
1.	Biology	a. Dra. Wardhani Indah E.	F	X
		b. Sri Laspitorini, SPd	F	XI A
		c. Dra. Sumarni	F	XI A, XII A
		d. Berkah Beno W., SPd	M	X
2.	Physics	a. Drs. Kardi	M	X, XII A
		b. Rohmatul Ummah, SPd	M	XI A
		c. Sri Lestari, SPd	F	X
3.	Chemistry	a. Sugeng Hadi T, SPd.	M	XI A, XII A
		b. Fatma Taufiyanti, S.Si	F	XI A
		c. Desi Ariani, SPd	F	X, XI

Source: The Principal Decree (SK Kepala Sekolah) of SMA Muhammadiyah 2 Yogyakarta No.E-2/ 0623/ a.12/ VII/ 2008

The researcher took 4 (four) science teachers international classes in SMA Muhammadiyah 2 Yogyakarta to be observed in the classroom activities. They are Sri Laspitorini, SPd and Berkah Beno W., SPd (Biology), Drs. Kardi (Physics) and Fatma Taufiyanti, S.Si (Chemistry).

Table 2 Observed Science Teachers in International Classes for Academic Year 2008/ 2009

No	Teacher's Name	Code	Class	Lesson	Main Topics	Date of Observation	Duration
1	Sri Laspitorini, SPd	A	XI IPA 2	Biology	Human Reproduction System	April, 30	90'
2	Berkah Beno W.	B					
3	Drs. Kardi	C	X B	Physics	Concave and Convex Lens	May, 4, 2009	90'
4	Fatma Taufiyanti,S.Si	D	XI IPA 1	Chemistry	Infra Red	May, 6, 2009	90'

Source: Research Data

D. RESEARCH FINDINGS

This classroom observation investigates how science teachers can use English and Bahasa Indonesia, and how they can encourage their students to use the bilingual expression. The bilingual use frequencies in science teachers' classroom expressions are reported on a teacher-by-teacher basis as presented in Table 4.

Table 3 Bilingual Use Frequencies Among Science Teachers in SMA Muhammadiyah 2 Yogyakarta

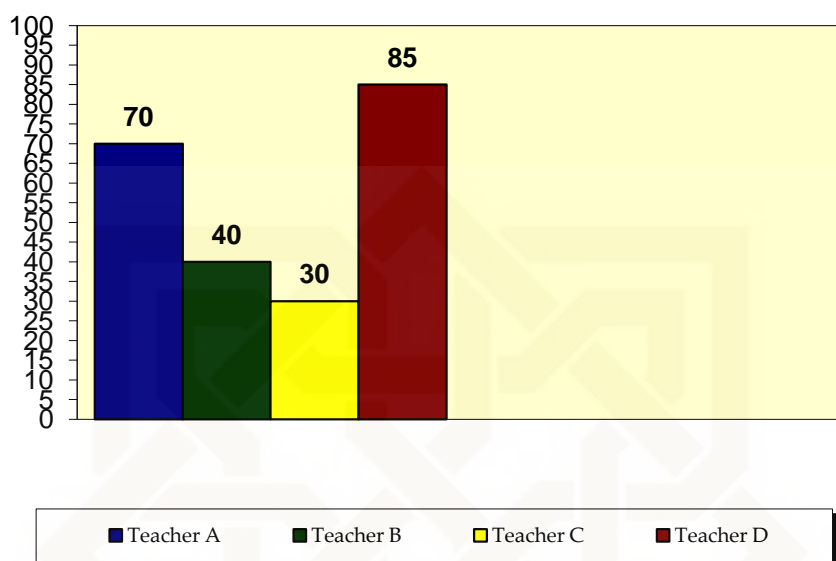
No	Teachers' Classroom Expressions	Language User							
		Teacher A		Teacher B		Teacher C		Teacher D	
		L1	L2	L1	L2	L1	L2	L1	L2
1	Greetings	20	70	50	40	60	30	10	85
2	Beginning the Lesson	30	70	40	60	70	30	20	80
3	Giving Order or Command	50	50	80	20	90	10	40	60
4	Asking Questions	50	50	80	20	90	10	40	60
5	Giving Explanation	50	50	70	30	90	10	40	60
6	Closing	50	50	70	30	90	10	40	60

Source: Research Data

a. Greetings

Usually, since SMA Muhammadiyah 2 Yogyakarta is a school based on Muhammadiyah values, the teachers started class activities by greeting students: 'As-Salāmu 'Alaykum' which literally means "peace be upon you". In addition, 'wa-Raḥmatullāhi wa-Barakātuhu' means "and the Mercy of God and His blessing". This is not a kind of greeting expression in Bahasa Indonesia, because it comes from Arabic language used for Islamic expression, but all teachers in the school use this expression since it is very common. Another expression for greeting is expressed in Bahasa Indonesia: "Selamat pagi, anak-anak..!" The word *selamat* means *safe*. So, *selamat pagi*, literally means *safe morning*. The greeting in Indonesian is not quite the same as that of English. The researcher recorded that all observed teachers used English expression for greeting students. Figure 9 describes the use of English expression in greetings among science teachers in SMA Muhammadiyah 2 Yogyakarta during class presentation. Teacher A and Teacher D used English expressions in greeting more explicit than Teacher B and C.

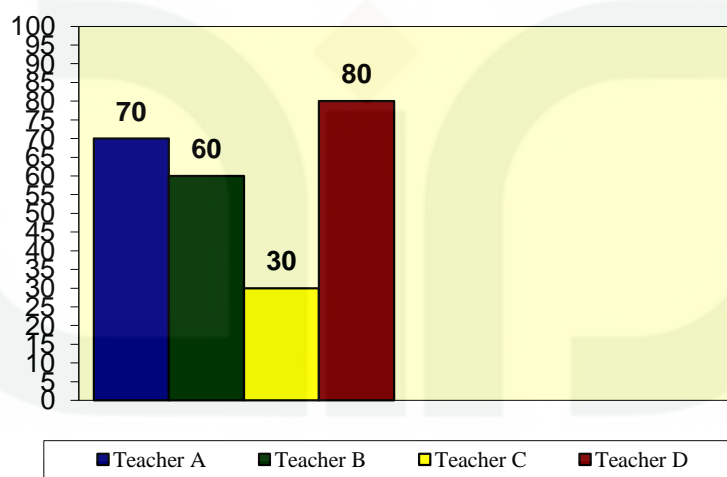
Figure 1
The Use of English Expressions in Greetings
Among Science Teachers in SMA Muhammadiyah 2 Yogyakarta



b. Beginning the Lesson

Figure 2 describes the use of English expression in beginning the lesson among science teachers in SMA Muhammadiyah 2 Yogyakarta during class presentation. Teacher D becomes the most brave performer in using L2 in beginning her presentation than others, while teacher C seems being comfortable in using L1.

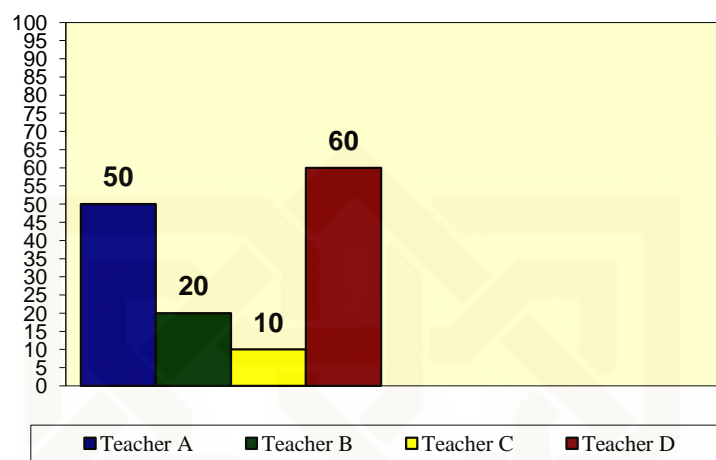
Figure 2
The Use of English Expressions in Beginning the Lesson
Among Science Teachers in SMA Muhammadiyah 2 Yogyakarta



c. Giving Order or Command

In giving order or command, a teacher usually asks the students to do something: opening a page of material books, writing an opinion, answering a question, working in pair and so on. This instruction will give a good impact to students in practicing L2 if the teacher gives it in L2. Anyway, Teacher A and D have more confidence to do so than Teacher B and C.

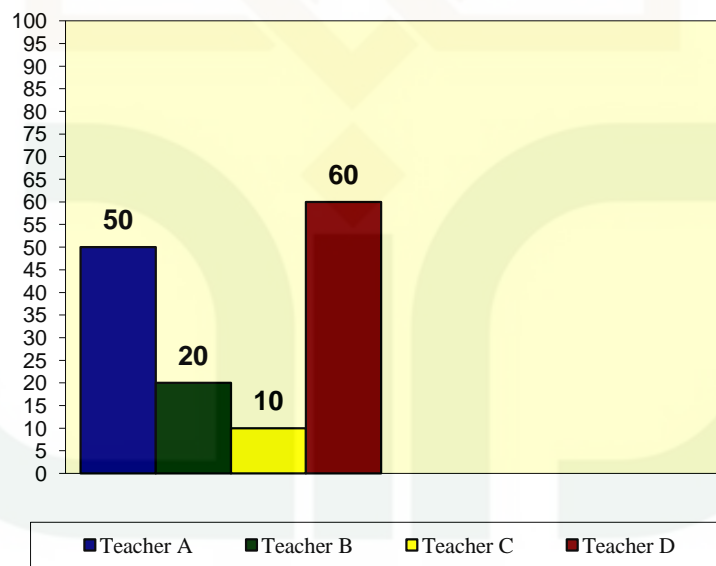
Figure 3.
The Use of English Expressions in Giving Order or Command
Among Science Teachers in SMA Muhammadiyah 2 Yogyakarta
During Class Presentation



d. Asking Questions

Asking questions is a good way to get feedback from students and evaluate their achievements. A teacher should be more careful in formulating the questions; they must be understood clearly by the students. In these sessions, teacher D uses 60 percents of her instructions in L2 while Teacher D uses only 10 percents.

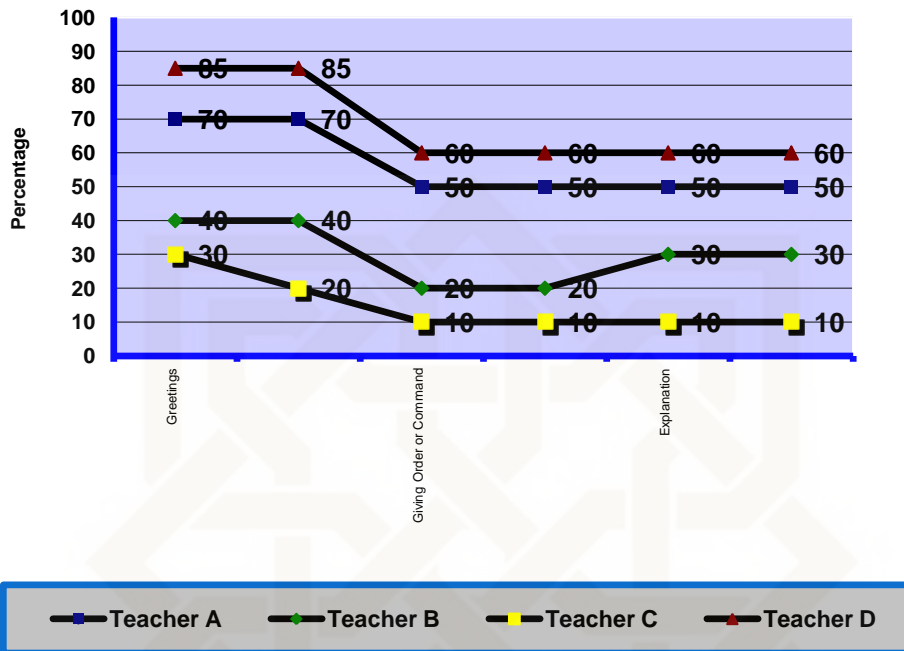
Figure 4.
The Use of English Expressions in Asking Questions
Among Science Teachers in SMA Muhammadiyah 2 Yogyakarta



e. The Use of English Expression

Overall, Teacher A uses 50:50 in almost of his presentation; Teacher B and C tend to use L1, and Teacher D is the one who brave to practice L2 during class presentation (Fig.5).

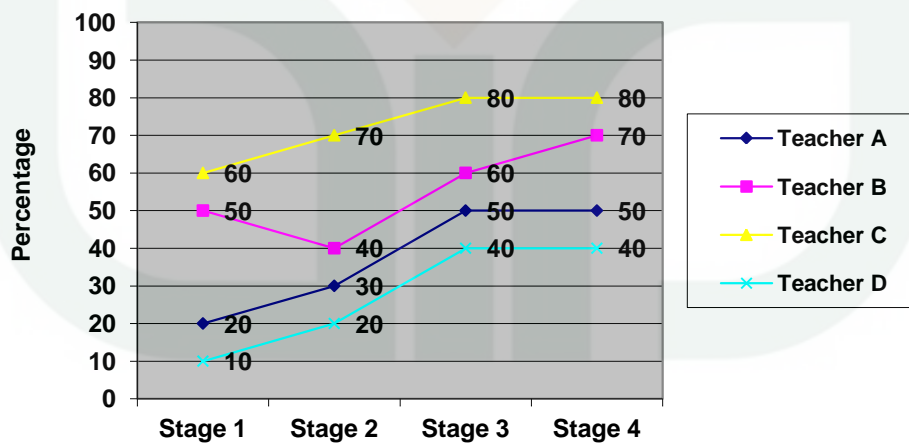
Figure 5. The Use of English Expression Among Science Teachers in SMA Muhammadiyah 2 Yogyakarta During Class Presentation



f. The Use of Bahasa Indonesia Expression

Figure 6 describes the use of Bahasa Indonesia expression among science teachers in SMA Muhammadiyah 2 Yogyakarta during class presentation. Teacher C is the most often using Bahasa in his class presentation while Teacher D balance the code switching in stage 3 and 4 to make sure the students can follow her presentation.

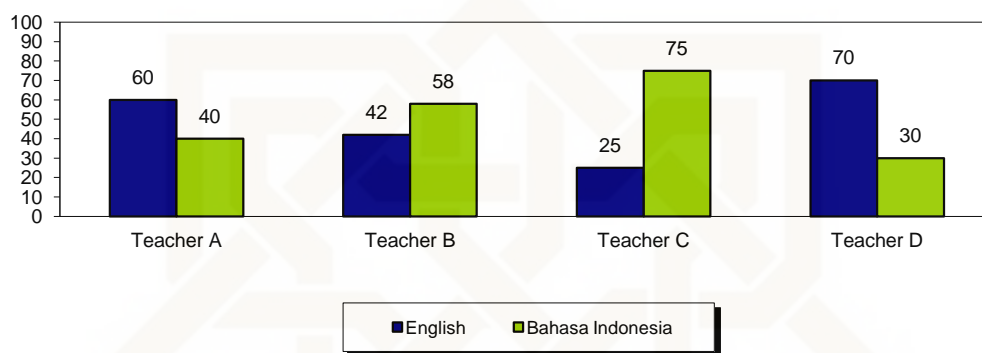
Figure 6 The Use of Bahasa Indonesia Expression Among Science Teachers in SMA Muhammadiyah 2 Yogyakarta During Class Presentation



g. The Comparative Use

Figure 7 demonstrates the comparative use of English and Bahasa Indonesia expression among science teachers in SMA Muhammadiyah 2 Yogyakarta during class presentation.

Figure 7
The Comparative Use of English and Bahasa Indonesia
Among Science Teachers in SMA Muhammadiyah 2 Yogyakarta
During Class Presentation



E. CONCLUSIONS AND SUGGESTIONS

1. Conclusion

In the surveyed classrooms, it is the content acquisition that becomes the central aim of science teaching. Most teachers prefer speaking in the first language (L1) to second one for keeping students able to follow their instructions. Although all of them support the bilingual education implementation in the school, some of them have been lack of using the bilingual approach in their classes. The classroom environment is largely dependent on the teacher. Success for all students in science through bilingual method must start with teachers believing that all students can and should learn in bilingual method. Teachers must commit themselves to teaching *all* students and be prepared to develop interesting and meaningful lessons that fully engage *all* students.

One way to apply the bilingual method in teaching science is to choose a strategy that is developmentally integrate the subjects content acquisition with the foreign language acquisition. The foreign language acquisition should be part of the broad curriculum in the school. It is necessary for teachers to have some knowledge as to how students are able to understand the concepts of science in the foreign language. Academic language in English should be more familiar in students and teachers activities in class.

2. Suggestion

Bilingual programs should be designed with the expectation that young school-age children learn second languages rather slowly and will need several years of learning before their English is as good as that of children who have been speaking it since birth. Furthermore, starting to speak English even as late as high school is no barrier to learning to speak it very well.

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