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Teaching Mathematics Bilingually for Kindergarten Students with Teaching Aids Based on Local Wisdom

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Abstract

Language and Mathematics are both skills and knowledge that need to master well so that it can be the provision for students' future life when mingling with the community or society. Because of that the integration of teaching both language and Mathematics in bilingual Math learning will give many benefits to the students. They will learn not only how to interact with others by improving their communication skills but also how to develop their Math concepts and skills. Moreover students will also get lots of advantages by learning Mathematics bilingually. This study aimed to find out the development of the students' English for Math ability in numbers and number sense in which the process of teaching learning is equipped with teaching aids based on local wisdom. The participants were 30 kindergarten students. The study used descriptive qualitative method and the results revealed that the teaching learning activities with teaching aids designed based on local wisdom have a significant effect on the development of both kindergarten students' performance in English for Math activities and their love toward the local products found in their surrounding environment.

Keywords: bilingual learning, English for math, teaching aids, local wisdom

1. Introduction

Early childhood is often referred to as "golden age" or golden period. At this time almost all the potential of children have a sensitive period to grow and develop rapidly and greatly. The development of each child is not the same because each individual has a different development. Nutritious and balanced foods and intensive stimulation are essential for such growth and development. If the child is given intensive stimulation from the environment, then the child will be able to undergo development tasks well.

The orientation of life needs to be grown from an early age so that children will be exposed to learn how to weigh and judge. This deep-rooted orientation is what is expected to be the driving force of life. If the orientation since the early childhood is good, then the adolescent child does not need to go through a crisis of identity and shake the soul. Because they have found it before the self-feels that are very important to them in adolescence. And adolescence without identity crisis is what we know as identity foreclosure (Jalal, 2003).

The purpose of learning mathematics for early childhood is to give students the opportunity to be prepared for their advanced knowledge, skills, and attitudes towards Math. So that it will create curious students who are active learners with a variety of knowledge, life experience, and individual background. A key component in developing successful arithmetic learning is by making connections to the background and experience (Kilpatrick & Swafford, 2001).

Counting can be defined as a combination of mathematical knowledge, problem solving and communication skills needed by everyone to function successfully in our technological world. Counting is more than knowing about numbers and number operations (Harun et al., 2017).

English for Math bilingual learning with teaching aids based on local wisdom for early childhood education focusing on developing the mathematical power that is an essential part of creating superior and qualified human resources. In the beginning, students recognize learning, for teachers it means that this phase is necessary consideration of providing critical and creative thinking skills that can be facilitated through learning mathematics. To be able to implement child development based on local wisdom hence it is necessary to develop

bilingual learning model that is English for Math for early childhood education. Because of that, this paper is finding out the development of the students' English for Math ability in numbers and number sense in which the process of teaching learning is equipped with teaching aids based on local wisdom.

1.1 Background of the Study

English for Math learning model is not something new in kindergarten schools. But this model will be successfully implemented if equipped with teaching aids that can improve students' motivation so that the process of teaching learning will be more fun and exciting.

One of the important subjects that is important for the betterment of students' capability in life skills is basic math. And some researches have shown that there is great advantage of integrating both language and math concepts that can be started from the earlier age in the early education and designed based on the age and the need of the students. The most important things in teaching very young learners are creating fun and exciting atmosphere of teaching learning process. One of the requirements that can support the fun and exciting teaching learning process is the implementation of teaching aids that are exiciting for the students. There are a lot of teaching aids that can be chosen to create the fun and exciting atmosphere. In order to satisfy the needs of the integration of language and Math and find the appropriate ways to teach English for Math as the integration of language and Math, the students' development of English for Math ability in number and number sense implemented with teaching aids based on local wisdom are investigated.

1.2 Bilingual Learning

Bilingual Education is education in an English language school system in which students with little fluency in English are taught in both their native language and English. On the other words, it can be said that in bilingual learning there is the use of two different languages in classroom instruction as bilingualism is the ability to communicate in two different languages (Calderon et al., 2003).

The broad impact of using two languages regularly by individuals who are bilingual is on language and cognitive functioning (Bialystok et al., 2009). Bilingualism has already been wide spread around the world and it will be more widely spread in the 21st century. The consequences of speaking two or more languages are its capability to delay the concept of Alzheimer's disease and potentially important impliatios for the concepts of cognitive reverse.

Bilingual instruction allows teachers and students to interact naturally and negotiate meanings together, creating participatory learning environments that are conducive to cognitive as well as linguistics development (Benson, 2005). Transfer of linguistic and cognitive skill can be found in bilingual teaching. Student learning can be accurately assessed in bilingual classrooms. When students can express themselves, teachers can diagnose what has been learned, what remains to be taught and which students need further assistance. In submersion schooling cognitive learning and language learning are confounded, making it difficult for teachers to determine whether students have difficulty understanding the concept itself, the language of instruction, or the language of the test. Students become bilingual and biliterate. Bilingual programs encourage learners to understand, speak, read and write in more than one language. In contrast, submersion programs attempt to promote skills in a new language by eliminating them from a known language, which may actually limit learner competence in both.

Children who experience two languages from birth typically become native speakers of both, while adults often struggle with second language learning and rarely attain native-like fluency (Ramírez & Kuhl, 2016). Studies consistently show that, besides the obvious practical and economic gains, bilingualism leads to a number of cognitive advantages. A growing body of research indicates that the experience of bilingualism alters not only the scope of language acquisition and use, but also a broader scope of cognitive processing from a very young age onward. Bilingual children perform equally well or better than monolinguals *when both languages are considered*. Studies suggest that optimal learning is achieved when children start learning two languages at an early age through high-quality interactions with live human beings, and both languages are supported throughout the toddler, preschool, and school years. Supportive environments for bilingual learning encourage parents and caregivers to use the language in which they are most fluent and comfortable, value both languages equally, and view bilingualism as an asset that brings about important cognitive, social, and economic benefits.

While our focus here has been on language development, it is also important to recognize that early childhood is also a time of profound emotional, social, physical, and cognitive development. Bilingualism will be a priority or even a necessity for some families. Other families might choose to focus on other aspects of development. In some cases, where families are not fluent in a second language, early bilingualism might be unrealistic. Here, it is important to keep two things in mind: 1) bilingualism is only one way to promote successful early

development, and 2) second language learning is possible at any age. Language is a window to the world. It is better for parents to provide plenty of input and interaction in a language they are comfortable in, than to hold back because they are not fluent or comfortable in the language (Byers-Heinlein & Lew-Williams, 2013).

1.3 Teaching Aids Based on Local Wisdom

Teaching aids are considered as a helping device to educate or teach students so as to make the concepts of teaching materials easy for them to comprehend. As a part of sciences, English for Math phenomena can be found in everyday life. Because of that, it is crucial to have teaching aids which can help to relate between English for Math subject with the phenomena occurred in everyday life, which is English for Math's teaching aids based on local wisdom. Local wisdom is a particular characteristic which originates from district or region that has cultural value developed within local people that are passed through from generation to generation. Teaching aids that are based on local wisdom can help students understand the relationship of their real life-world and what they are learning in English for Math materials. Through local wisdom, students can study and understand the values of the culture and sense of nationalism that may affect their learning outcomes in the forms of attitudes, behavior, and thinking ability (Laurents et al., 2014; Meliono, 2011; Wulaningrum & Priyambodo, 2016).

Using aids as a teaching method will stimulate thinking and improve learning environtment in a classroom. It means that the effective use of teaching aids will be able to substitute monotonous learning environtments. Students will be trained to develop and increase personal understanding of the areas they are learning. They will be exposed to a successful and pleasant learning in the classroom.

Both teachers and students will find out that learning objects and materials are useful and relevant when it has come direct relation to the objects that are easily found in their environment (Shabiralyani et al., 2015).

Teaching objects and materials that meet the need and the age of the learners will offer a direct, tactile experience for the students and help them to achieve better understanding of the topics presented. Hands-on learning is a rewarding, essential experience for all learners in which some of them will give the respond more readily to objects compare to the abstract teaching materials.

Teaching with objects is a powerful way to facilitate concept learning that can help students to develop their high levels of reasoning and assessment abilities such as compiling evidence through sight, touch, hearing, smell, and even taste. It can also arouse their interest and needs in which they can work cooperatively, share their learning with companions, and pool their knowledge. Most importantly, it also arouses students' curiousity so that they will be triggered to develop their own questions by exploring the items they are studying and developing strategies for answering those questions (Sieber & Hatcher, 2012).

1.4 English for Math

English for Math is teaching a curricular subject that is Math through the medium of a language other than that which is normally used. It means that learners will learn Math in English that is conveyed bilingually to make them better understand the content they are learning. Futhermore in English for Math, learners gain knowledge of the curriculum subject while simultaneously learning and using the foreign language that is English. In the implementation of English for Math learning model, it is important to notice the 'content' because curricular content will bring learners to language learning (Cambridge ESOL, 2010).

According to Barnaby (2015) integration in the process of teaching learning is regarded as an effective way to connect subjects that purposefully draws together knowledge, skills, attitudes and values from within or across subject areas to develop a more powerful understanding of key ideas in the classroom. Integrating language and mathematics in the classroom practice is an effective way to engage students to develop both their communication and math concepts and skills by using learning aids that is appropriate with the need and the age of the students. The previous of teaching way is individual guided practice, individual memorizing. To activate students more, it is significant for the teachers to change ways of teaching in which teachers are supposed to provide group-based instruction and experiencing through discussion and problem solving. Knowing math in students' own language is good and knowing math in English will make students learn better. There are many advantages of integrating the skills of language and mathematics. One of them is that it is really important for a student to know the language of mathematics (Jamison, 2000; Devlin, 2009). It means that the students can count with the numbers but they may feel that the language is difficult. So, the integration of language and math skills situate students to have learned many words for the mathematic language.

The conversation strategy that can be applied in integrating language and math into English for Math is by encouraging students to explain how they think. There should be the session of confirming and clarifying

students' examples, inserting mathematical words, moving between mathematical language and everyday language. Teachers should support the students by challanging them to progess in their thinking (Neal, 2007; Abramovits, 2011). There should be also the examples of concretization, summaries to clarify. Teachers should also provide time to highlight students' different experiences. The integration of language and mathematics learning will make a very active math lesson in which students will get lots of opportunities to interpret their daily math problems into a mathematical problem together with the teachers. The next advantage is there are also chances for the students to develop their own knowledge each lesson in different ways through discussion. It is interesting to create the students' own task that are outside the textbook.

2. Research Methods

This type of qualitative research was conducted to describe the impact of English for Math learning model that is taught to the kindergarten students bilingually on the development of English for Math ability in numbers and number sense.

The method of this research is qualitative research and the data of the research are analyzed descriptively qualitative. Qualitative research methods aim to understand or interpret phenomena in the sense of meaning Qualitative research can determine the initial question which can then be addressed in quantitative studies. Qualitative data analysis can be done using explicit, systematic, and reproductive methods. By using this method, it is expected to get a complete picture of the kindergarten students' development of English for Math ability in numbers and number sense.

2.1 Participant

30 students at *Mekar Jaya* Kindergarten in Semarang, Indonesia, took part in this study. The range of their age was from 5-6 years old. As there was no randomization in selecting the participants in this study, the participants of the 30 very young learners were chosen as the sample of the study. All the very young learners were exposed to the teaching of English for Math in which the activities were supported by teaching aids designed based on the local wisdom.

2.2 Instrument

As the first purpose of this study was to investigate the students' development of English for Math ability in numbers and number sense by using teaching aids based on local wisdom, a couple of instuments were used to collect the data. Observation, questionnaire, documentation were administered during the study. The instruments aimed at finding out the students' developement of English for Math ability in number and number sense implemented with teaching aids based on local wisdom.

In order to investigate the research question that was qualitative, an observation checklist was designed by the researchers consisting of 8 indicator points as stated in Table 1.

Table 1. English for math ability in numbers and number sense

Indicators
1) Asks and answers simple question about number, then Demonstrates an increasing ability to count in sequence to 10 and beyond
2) Develop increasing abilities to understand and use language to communicate information, experiences, ideas, questions, and for other varied purposes, then matches a number of objects with written numeral
3) Uses an increasingly complex and varied spoken vocabulary, so that understands that numbers have multiple
uses [e.g., measurement, recipes, prices, and ages (self and peers), phone numbers and street numbers]
4) Communicates clearly enough to be understood by familiar and unfamiliar listeners.
Demonstrates increasing interest and awareness of numbers and counting as a means for solving problems and determining quantity
5) Progresses in listening to and understanding the English language while maintaining home language.
In this case, Identifies positions of objects in a sequence
6) Seeks out and enjoys experience with teaching objects and materials.
Uses one-to-one correspondence in counting objects and matching groups of objects

7) Listens to and communicates information about matching objects and numbers.

Shows growth in matching, sorting, putting in a series, and regrouping objects according to one or two attributes such as color, shape, or size

8) Makes observations about the use of words, pictures, and objects

Demonstrates understanding of concepts whole and part

Adopted from Maine Department of Education (2005).

The development of students' English for math ability in numbers and number sense that are categorized into four criteria. Those are Undeveloped (U), Start Developing (SD), Developed as Expected (DAE), and Very Well Developed (VWD). The area of development is under eight points of indicators.

2.3 Research Design

This study made the use of qualitative method that enabled the researchers to get the deepest view of the research field by going through the close association with participants during the process of teaching learning in the classroom practice (Savenye & Robinson, 2005). The data in this study was collected through Observation, questionnaire, and documentation. The researchers took notes on the important information related to the students' perfomance on their ability following the activities in learning math bilingually supported by teaching aids that are based on local wisdom.

3. Results

This section provides the development of kindergarten students' performance on English for Math ability especially in the activities of indentifying number and number sense by using teaching aids designed based on local wisdom. In this case, the teaching learning activities are aimed at developing not only students' capability in communication and math concepts, but also their love towards the local products of their country. They were also trained through the English for Math activities that require them to learn and perform their capability of knowing numbers by matching the numbers and the objects, do the substruction and addition according to the objects they saw in teaching materials they were learning.

Table 2. The development of English for math ability in numbers and number sense

Indicators	**Examples You May Observe**	**Student Development**			
		U	**SD**	**DAE**	**VWD**
1• Asks and answers simple question about number, then Demonstrates an increasing ability to count in sequence to 10 and beyond	Child asks and answer simple questions about number. Ex. What number it is? It is number 1 Child counts to ten using spoken words, signs, gestures, or pictures.	4 (13%)	8 (27%)	8 (27%)	10 (33%)
2• Develop increasing abilities to understand and use language to communicate information, experiences, ideas, questions, and for other varied purposes, then matches a number of objects with written numeral	Child understands the questions given bilingually Child matches one chicken (or other objects) to the written numeral "1".	6 (20%)	6 (20%)	8 (27%)	10 (33%)
3• Uses an increasingly complex and varied spoken vocabulary, so that Understands that numbers have multiple uses [e.g., measurement, recipes, prices, and ages (self and peers),	Childs understand the questions given bilingually Child says, "I live at Jl. Hatta No. 223 Semarang."	4 (13%)	8 (27%)	8 (27%)	10 (33%)

phone numbers and street numbers]					
4• Communicates clearly enough to be understood by familiar and unfamiliar listeners. Demonstrates increasing interest and awareness of numbers and counting as a means for solving problems and determining quantity	Child undertands the instruction given by the teachers bilingually Child says, "We need three more cups at the snack table" or indicates the need for three more cups by bringing them over to the snack table.	4 (13%)	8 (27%)	10 (33%)	8 (27%)
5• Progresses in listening to and understanding the English language while maintaining home language. In this case, Identifies positions of objects in a sequence	Child understands the questions and instructions given bilingually. Child says, "I'm first in line, she's second"	2 (7%)	8 (27%)	10 (33%)	10 (33%)
6• Seeks out and enjoys experience with teaching objects and materials. Uses one-to-one correspondence in counting objects and matching groups of objects	Child understands the questions given bilingually. Child touches or points to objects such as crackers while using or hearing phrases such as "one for my friend Rara, one for my friend Halim, one for me."	2 (7%)	6 (20%)	12 (40%)	10 (33%)
7• Listens to and communicates information about matching objects and numbers. Shows growth in matching, sorting, putting in a series, and regrouping objects according to one or two attributes such as color, shape, or size	Child is good at grouping objects. Child puts all the small red tomatoes together.	2 (7%)	8 (27%)	10 (33%)	10 (33%)
8• Makes observations about the use of words, pictures, and objects Demonstrates understanding of concepts whole and part	Child is good at adding and substructing. Child practices about addition and substraction.	5 (17%)	5 (17%)	10 (33%)	10 (33%)

Adopted from Maine Department of Education (2005).

Note. U: Undeveloped.

SD: Start Developing.

DAE: Developed as Expected.

VWD: Very Well Developed.

The research findings show that there is the development of students' English for math ability in numbers and number sense that are categorized into for criteria. Those are Undeveloped (U), Start Developing (SD), Developed as Expected (DAE), and Very Well Developed (VWD). The area of development is under eight points of indicators.

From the first indicator of asking and answering simple questions about number, and then demonstrating an increasing ability to count in sequence to 10 and beyon, it shows that only 13 % of the students or 4 students out of 30 students are in the progress of being undeveloped. It means that most of the students are in the category of student development of Start Developing, Developed as Expected, and Very Well Developed.

Then at the point second indicator that is the abilities to understand and use languge to communicate and match a

number of objects with written numeral, most of the students are in the category of Start Developing, Developed as Expected, and Very Well Developed. Or only 6 students out of 30 or 20% of the students get the category of Undeveloped.

It can be seen from table 1 above that the third indicator until the eight indicator, the capability of the students on the process of teaching learning on the integration of language and math in the design of English for math supported by teaching objects and materials based on local wisdom are satisfying. The table shows that only 2-5% of the students are in the category of Undeveloped in their participation and performance during the implementation of English for Math in the classroom practice. It means that the rest of the students are already in the category of Start Developing, Developed as Expected, and Very Well Developed.

The results of the research also show most of the students or between 87% until 95 % of the students state that they are very happy in joining the English for Math activities. They also say that they get more experience during the implementation of English for Math learning Activities. They learn more about number and number sense by using the aids of fruits, traditional snacks, natural products that are all local products in their environment. They hav e more knowledge and insight about local wisdom products that can foster more to love them. Learning Math is becoming fun for them and they feel that they are playing while learning. The result of the students' questionnaire can be seen on Figure 1.

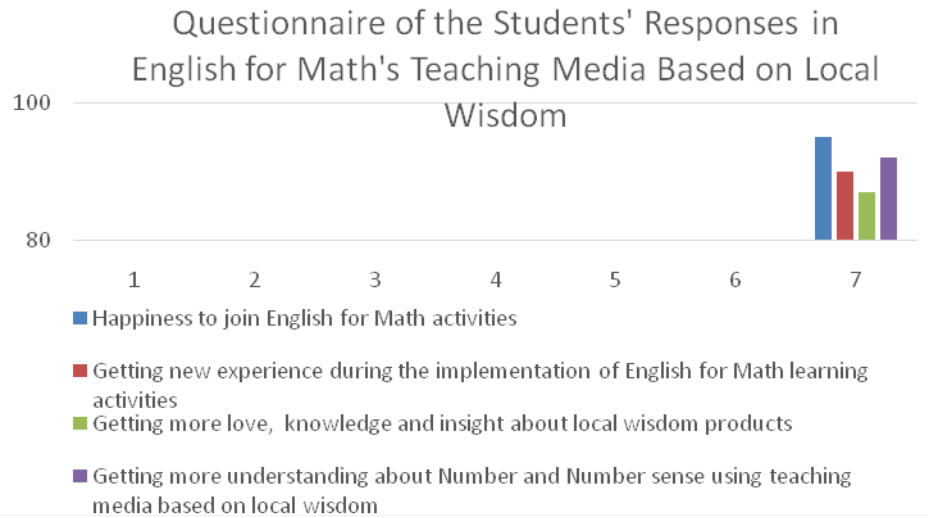

Figure 1. Questionnaire of the students' responses in English for math's teaching media based on local wisdom

4. Discussion

Introducing basic math that is integrated with language is very important to develop students understanding on problem solving and concepts. And teaching bilingual language as the part of teaching language to students as the additional language mastery after the L1 gives many benefits to young learners. They will develop not only their cognitive thingking but also they can better adjust to environmental changes, and later the will also experience less cognitive decline (Marian & Shook, 2012). Zelasko and Antunez (2000) also give additional benefits of learning bilingual that is students will have the capability of making friends easier. It means that they have important personal skills to mingle with new society. Becoming bilingual supports children to foster their capability of self-control and maintain strong ties with their entire family, culture, and community and it is the sign of the school success of a student (Kovács & Mehler, 2009).

Mathematics plays a big role in society that values intelligence. Because of that it is very important if students' minds are provided with basic numeracy skills to function effectively in society and acquire meaningful and prospective jobs in the future life (Cooney & Jones, 2011). On the other words, it is important to introduce basic math to very young learners as it will give them exercise how to sharpen their cognitive thingking that is needed to improve the life skills needed in the future. And to minimize or even to eliminate the fear of learning mathematics, it is significant for early childhood educators to provide the very young learnings with activities that are fun and exciting. The atmosphere of exciting and fun learning activities can be obtained through the

implementation of teaching objects and materials that are designed based on local wisdom such as traditional food, traditional snacks that can only be found in the traditional market, local fruits, local plants, local flowers, sands, seashells, and many others of local products that can be found in the environment easily. Using those teaching objects and materials, students will learn about basic math such as substraction, addition, and matching objects with the numbers. It is found out that the teaching objects and materials are helpful in connecting math with the real life so that it also helped the students to express their ideas about basic math concepts. For example, it is not difficult for them to count how many flowers a plant has or even to count how many mangoes are in the basket. And the process of English for Math activities are conveyed bilingually and adjusted to the need, age, and level of students' difficulty.

This study was to find out the students' development of English for Math ability in numbers and number sense that was conveyed bilingually during the process of teaching learning. It is proved through the researh findings that English for Math activities that were conveyed bilingually are quite fun and exciting to be implemented to the very young learners in kindergarten schools. The fun and exciting atmosphere is supported by the teaching objects and materials that are designed based on the local wisdom. Moreover the use of these teaching objects and materials also improve and foster the students' love on the local products that can be found in their environment.

5. Conclusion

Basic math is important to be introduced to the very young learners in kindergarten schools. Simple mathematical concepts should be introduced earliear, starting from kindergarten schools (Concordia University, 2012). By introducing children to basic terminology early in childhood and introducing math concepts, it will prepare them to the future life skills. And teaching math bilingually will also improve students' cognitive skilss and students' understanding of concepts and problem solving. And their understanding will be better developed if it is supported by teaching objects and materials. the purpose of using teaching objects and materials are for creating the fun and exciting atmosphere. One way of choosing and selecting teaching objects and materials should be based on the students' need, age, and level of difficulty.

Children are naturally visual and can build relationships between numbers and a represented item. Using representation or pictures as the teaching objects and materials in teaching math is very helpful to clarify a relationship that can make the use of mathematics real to a child's mind (Stanberry, 2017). The selection of teaching objects and materials that are designed based on local wisdom. The purpose of that selection is to make the students get easier in understanding the activities of English for Math learning activies, besides fostering their love of the local products that are easily found in the environment.

Teaching through representation such as pictures, real objects, or even realia will allow children to make connections between the real world and the math skills that are vital for academic success (Bailey, 2014). Objects and materials used in teaching math can help to make a connection between life and math, so that children will not become confused about the information provided in a classroom. Because of that, this study makes the use of teaching objects and materials designed based on local wisdom to help students understanding on the math concepts that they can understand it better bilingually. Language is as a vital to building a mathematics foundation, children need to learn how to use their own vocabulary to describe objects and relationship. It is importan to helping children form cognitive connections between concrete objects and abstract objects (Shaw, 2012).

Basic math taught for kindergarten students can be focusing on the basics of adding and subtracting, teachers that can provide a stronger foundation in math skills for the future. Depending on the age of children, the basics of adding and subtracting might limit the skills to sharing food items and other objects or adding items to play activities that encourage children to count the extra items (Ontario, 2011). Teaching objects and materials based on local wisdom is a good teaching aids that can be used in class to promoto students' interests on the topic they are learning. Teachers can make the use of examples that arise during play activities to teach the ideas of adding or subtracting items. It is an opportunity to teach the skills without actively creating lesson plans that are too advanced for childhood literacy and knowledge.

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