WINNING INTERNATIONAL MATHEMATIC OLYMPIAD THROUGH CREATIVE ENGLISH TEACHERS: APPLIED LINGUISTIC PERSPECTIVE

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Abstract

International Mathematic Olympiad is a prestigious event for school and even country to join. It is an arena to secure a benchmark of how advanced the school/country is in preparing young qualified generation. For countries where English is a second/foreign language, International Olympiad is a serious challenge since all problems are in English. It is suspected that the students' failure to answer the questions determined by their low comprehension on linguistic elements and item tests as a discourse. What can English teachers do to assist students to win the competition? Both English and mathematic teachers play four roles altogether in: designing a comprehensive curriculum which covers both mathematic and language skills; improving teaching strategies; developing materials; and applying suggested teaching models. This study recommends that English and mathematic teachers can stand as curriculum designers and implementers by unifying mathematic and English skills on each level of courses

Keywords: mathematic Olympiad, linguistics elements, comprehension, curriculum designers.

One of the activities that mathematics talented children engaged into is mathematic Olympiad (Astawa, 2007). According to Gardner's research in 1981, as cited in Campbell et al. (2000), the sign of the special talent in mathematic appears during children's development period. Various activities are taken in order to improve children's mathematics skill, including after school extra-curriculum courses by specialized maths teachers, or other specialized training programs for such purpose (Campbell et al., 2000).

During the period of training, the students are encouraged to participate in mathematic competitions or Olympiad, either in the national scope or even international. There is no exception to the elementary students. There are some international mathematic Olympiads which these groups regularly participate. They are IMAS head-quartered in Taiwan, AIMO which last year (2014) final round held in China, IMC in Singapore, and AMC centred in Australia or United States. These competitions participated by junior high school students as well as elementary school students. The elementary school category is divided into Middle Primary (3rd and 4th grade) and Upper Primary (5th and 6th grade).

The great potential of the elementary students are often hindered by the obstacle of their English capacity. Due to its international scope, all of the problems are in English stated in the form of mathematical technical termswhich require critical thinking. Therefore, it is important to find certain solutions and strategies to deal with.

According to prior observation, the obstacle in the training of solving problems from international mathematic Olympiad is the problem of understanding the language, not the mathematic capabilities. This could be seen as the questions are translated into Bahasa Indonesia. The average rate of the correct answer of the translated problems are 90%, while the average rate of correct answers if the problems are still in English are 50-70%. The points are deducted from students' weekly exercises. It could also be seen from other data of the average point of MNR

Competition (Indonesian Mathematics Competition) and the average point of IMAS of the students in Surabaya. The data shows that students participated in IMAS have the success rate of 70%, while others are below 60%.

The current development of teaching models of mathematic Olympiad are still limited to national scope (using Bahasa Indonesia), which have been performed by Astawa (2007). There is still no teaching model of mathematical Olympiad structured for international level, while English is not taught in elementary level, and there is a lack of English enrichment for mathematic technical terms. Therefore, a specific teaching model created for international mathematic Olympiad using English is needed for elementary level.

THE PROBLEM OF LEARNING MATHS USING NON-NATIVE LANGUAGE

The mathematic issues in elementary grade have been going around in many countries, including USA. There are many immigrants of elementary level in USA use their own native languages, which are mostly Latin (Spain), and Asian (Abedi and Lord, 2001; Fuchs et al., 2006; Martiniello, 2008). Abedi and Carol (2001) conducted a research on the differences of mathematic abilities of elementary students whose native language is English and those whose native languages are non-English. The results show that the students whose native languages are non-English have lower competences as compared to those who are native English speaker. Abedi and Carol (2001) specifically stated that the students whose background are non-English speakers are more unlucky in their mathematics school test.

Another country interested in studying the problem of competence of non-English native speaker is New Zealand. The case study of Neville-Barton and Barton (2005) in New Zealand shows that high school students whose native languages are non-English have 15% lower score than that of native language is English. Their problem lies on the mathematic concepts; not their English vocabulary. A case study in a school where the non-English native students have a good average mark for English shows that they have problem in their mathematic technical terms (Neville-Barton and Barton, 2005). In the third school, the major problem of the non-English native students is their low capacity of English. From these three case-studies, Neville-Barton and Barton (2005) concluded that the low mathematic competence of the non-English students is related to the problem of their general English capacity and the technical vocabulary or terms of mathematics. In solving mathematic problems, they tend to memorize the mathematical procedure without taking serious attention to vocabularies and context of the maths.

Abedi et al. (2004) have reviewed various efforts of the states in USA to minimize the language obstacles of students who learn by their non-native languages. There are several solutions have been tried, namely: using bilingual dictionary or word list of translated English, direct interpretion, two version of language (English and native), and simplified English. One of the suggestions to improve the result of mathematic test is to conduct the test using the language they used in learning maths. It means that if they learn maths using their first language (e.g. Bahasa Indonesia), it should be tested using their first language (Bahasa Indonesia).

English modification training, according to Abedi et al. (2004), focuses on: *low frequency vocabulary* and *passive voice construction*. Both are specific characteristics of mathematic problems. They maintained that the use of commercial dictionary could not help the students to understand the mathematic concepts of the English maths problem. In addition, the list of words or glossary has proven to successfully help students in understanding mathematic problems. Alongside with the training of English modification of mathematic problems, another research by Mueller and Maher (2009) shows that a good communication of maths teachers and students in building the comprehension of mathematical concept is needed. This communication is undoubtedly in the language that the students understand.

Another method to help non-English students solving mathematic words problem is using digital media, such as educational software of VETA learning game (Lantz-Andersson, Linderoth, and Saljo, 2009). Lantz-Andersson et al. (2009) have successfully showed that the use of math software in the class together with student-teacher communication could build the understanding of mathematic concept. As Mueller and Maher (2009) have discovered, the key is the interaction of teachers and students while using the software (Lantz-Andersson et al., 2009).

In his review of automatic item generation, Dean and Sheehan (2003) explain that one of the softwares that can be used to generate similarly structured math words problem with similar difficulty level by standard language (not algorithmic language) is Math Test Creation Assistant (MTCA). The main point of Deane and Sheehan (2003) suggestion is to generate English vocabularies for similar problems, such as in (01) below.

(01) A ____ travelled ___ miles in ___ hours. On average, how fast did the ____ move during this time period?
((Deane and Sheehan, 2003:8)

This could be substituted with other words or structures as (02).

(02) It took ___ hours for a ____ to go ____ miles. What was the _____'s average speed?
(Deane and Sheehan, 2003:8)

This pattern could be applied to teach math using English for math focused to Olympiad of elementary students in Indonesia and other countries where English is not their first language. Mathematic technical terms discovered by Deane and Sheehan (2003:6) are: motion, current, age, coin, work, part, dry mixture, wet mixture, percentage, ratio, unit cost, mark-up/discount/profit, interest, direct variation, inverse variation, digit, rectangle, circle, triangle, series, consecutive integer, physics, probability, arithmetic, and word.

There is a research on mathematic Olympiad teaching model for elementary students. In Bali, Astawa (2007) conducted a trial whether a course consists of 30% of theory improvement, 50% of problem exercise, and 20% of moderation could boost academic ability of the Olympiad candidates in the sampled school. The language used in the math word problem in his research is Bahasa Indonesia. He claimed that his teaching model could significantly improve the academic capacity of the participants of the national science Olympiad. In addition, he also tested whether the two teaching models of "continue block" and "discreet block" produce a different result.

In the continue block teaching model, the participants of the Olympiad are quarantined for 2 weeks, so they are physically and mentally separated from their parents or guardian. In discreet block model, the participants are engaged in a weekly course, so they are not physically and mentally separated from their parents or guardian for a long time (Astawa, 2007:275-276). He concluded that there is no significant difference of the two models in improving logical mathematics capacity of the Olympiad's candidates. Note that both models improve logical mathematic capacity of the Olympiad's candidates. Astawa (2007:281) claimed that the important factors in improving mathematic capacity of the elementary mathematic Olympiad are the improvement of basic mathematics concept and the exercises of math word problems.

It could be concluded that there is no research on mathematic Olympiad teaching particularly mathematic technical terms for elementary students at international level. Astawa's research (2007) is only on the national level which uses Bahasa Indonesia, yet, international mathematic Olympiad uses English. A research in USA by Fuchs et al. (2006) shows that mathematic words problem is strongly related to the student's capacity in solving non-verbal problem, concept building, efficiency in reading words, and the student's language. The importance of students' teaching in winning the Olympiad in international level is critical; therefore this research will explain especially the role of English teachers in preparing the students to face international mathematic Olympiad.

METHODS

This paper is a part of research uses qualitative approach (Gall et al. 2003). This is relevant to the data, purpose, data collection method, and data analysis technique in this research (Ary et al. 2010). Furthermore, the research data are not in the form of number, but in the form of words, phrase, and sentences, and learning activities. The purpose of this research is not for hypothesis verification, but a case of seeking answer to the problems. The data collection techniques are observation and competency test. More importantly, the data analysis technique in this research does not require statistical calculation (Corbin and Strauss, 2008).

The subjects of the research are 5th grade elementary students who are members of Klinik Pendidikan Matematika (KPM) Surabaya. In addition, the teachers of KPM are also being the research's subjects involved in the observation process.

Observation is focused on the problems occurred in learning process. The aspects of the observation are the teacher-student interaction, the question asked by the students to teacher, the situation while students tried solving problems, and the students' answer, either spoken or written, including math test result. In addition, the students took maths competency test to determine their competence on linguistic elements and the overall math problems.

However, this paper is specifically focused on the literature review. This literature review aimed to find strategy in overcoming language problems and students' comprehension in solving international mathematics Olympiad problems, by investigating related references.

FINDING AND DISCUSSION

PRIOR WORK ABOUT ISSUES IN LINGUISTIC ELEMENTS AND MATH PROBLEM UNDERSTANDING

The comprehension of math problem is influenced by the competence of linguistic elements. The context of comprehension of math problems in this case is the student's overall comprehension of math problems in English. The indicator of student's comprehension is the accuracy of the answers of the math problems. The data of student's linguistic comprehension and the mathematical word problems refer to the finding of Setiawan et al. (2015). As indicated in Table 1 at "Material" label in fourth and fifth rows, the students' comprehension level of the mathematic problems is very low. From ten problems, only one problem (problem 1) could be understood by half of the students, or 53, 7%. It proved that if students fail to understand linguistic elements at any level, the overall comprehension of math problem will also fail.

Table 1: Summary of competency test of English mathematic word problem

Number	1	2	3	4	5	6	7	8	9	10
Language	26	22	3	4	2	17	13	3	3	2
%	63.4	53.7	7.3	9.8	4.9	41.5	31.7	7.3	7.3	4.9
Material	22	14	1	2	0	3	1	3	0	1
%	53.7	34.1	2.4	4.9	0	7.3	2.4	7.3	0	2.4

THE FACTOR OF LINGUISTIC ELEMENT COMPREHENSION

In more detailed view, it could be seen that students' language comprehension level is higher than the math problem comprehension. It is expected that the students' problem comprehension rate is at least in the same level with language comprehension rate. However, the result is different from the expectation. The students' problem comprehension is lower than their language comprehension. Although the students could understand the linguistic elements, they fail to comprehend the overall math problem. The examples are problem 5 and 9. There are two students who could understand the language in problem 5; however, both of them fail to understand the overall math problems. Similar phenomena could be seen in problems 9; there are three students who understand the language but fail to understand the overall math problems. From this evidences, it could be concluded that the comprehension of linguistic elements doesn't ensure the comprehension on overall math problems.

THE FACTOR OF TECHNICAL TERMS COMPREHENSION

Technical terms are found in almost every mathematic technical word problems. The understanding of these terms is strictly required to get a correct answer. Take a look at following problem 2.

Problem 2

Find the sum of all multiples of 5 from 5 to 200.

This question contains the technical term; *sum* which means "jumlah" in Bahasa Indonesia and *multiples* which means "kelipatan" in Bahasa Indonesia. Failing to understand either term would result in a wrong answer, the students then interpreted this problem in several ways.

(1) Students only write a row of numbers which are multiple of 5 in the range of 5 to 200.
(2) Students only write the sum of the multiple of 5 numbers.
(3) Students write a row of numbers which are multiple of 5 in the range of 5 to 200, then sum them all.

From Table 1 it could be seen that out of 41 students, only 14 students or 34.1% could understand these technical terms.

TRANSFORMATION FACTOR: VERBAL LANGUAGE TO MATHEMATICAL NOTATION

The third determined factor of English math problem comprehension is the ability to transform verbal language to mathematical notation. All ten kinds of given Olympiad problems use verbal language, and six of them are mathematic word problems, which are: problem 1, 3, 6, 7, 8, and 10. None of them are mathematic notation model, such as: $(10 + 3) - 4 =$........, and its similar kind. The following problem 5 is an example of the verbal mathematic problem.

Problem 5

How many positive whole number less than 2005 can be found, if the number is equal to the sum of two consecutive whole numbers and also equal to the sum of three consecutive whole numbers?

There is no hint of mathematic operational symbol in the problem; therefore, a meticulous skill of transforming verbal language to mathematical notation is very important. The following is the mathematical notation of the problem 5. None of the students could answer this kind of math problem.

The previous data indicate that KPM participants have difficulties in solving math problem because most of them did not understand the mathematic technical terms. Most of the students do not understand the words *remaining*, *intersection point*, *two-third the height*, and so on. The fact is that many of the English to Bahasa Indonesia translated math problems are incomplete; not translated into Bahasa Indonesia; not using equivalent terms, and many of the students unable to translate. Therefore, a strategy to overcome language issues in mathematic word problem is needed.

THE ROLE OF ENGLISH TEACHER

From the discovered facts, a teaching model made especially for international mathematic Olympiad at elementary level is needed. This activity is closely related to mathematic and English teachers. This part will explain the learning strategies of elementary mathematic Olympiad with the scope as follow: curriculum design, material building, study process, and assessment procedure.

CURRICULUM DESIGN

The curriculum need to be designed comprehensively by considering two aspects: maths and language. The learning strategy proposed for this purpose is SLAMS (*Second Language Approach to Mathematics Skills*) by Chamot (1982) with some modifications as shown in Figure 1.

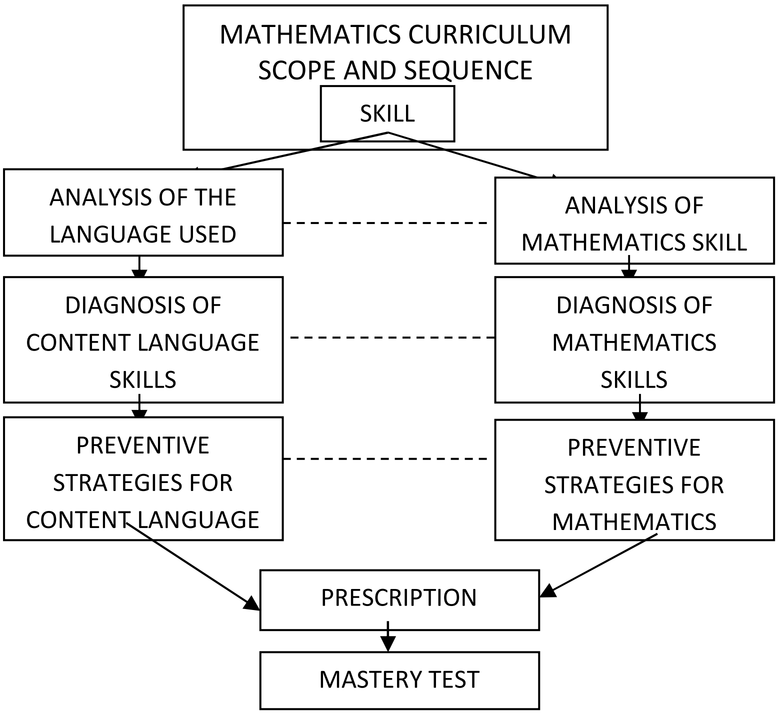

Figure 1. The modified teaching model of Second Language Approach to Mathematics Skills (SLAMS) by Chamot (1982)

The Figure 1 above shows the phases of curriculum design which combine math and English. The steps of the plan always designed in parallel as the left side of language material and the right side of mathematic material. However, in its original source, they are not directly related. Therefore, in this research the figure is modified by drawing connecting line between right and left side on each phase. The line is meant to illustrate the inseparable connection between language and mathematic materials.

The figure is initially intended to minority immigrants in their new English speaking home. The minority immigrants have difficulties in understanding mathematic in English, because English is their second or foreign language. This is similar to the students who study for international mathematic Olympiad in Indonesia. All of the math problems are in English, while for Indonesian students, English is their second or foreign language. Although it has different social context, the diagram portrays exactly what happens to English mathematic learners in Indonesia

The first phase is language practice analysis and mathematic competence analysis. In this phase the English and mathematic teachers co-operate to decide the competency the students need to attain as suggested by Ríordáin & O'Donoghue (2008:59). Mathematics teacher determines the math competence, while English teacher determine the linguistic competence which is the elaboration of mathematic competence. In the second phase, both teachers develop contents based on their roles. For example, the math teachers develop math problems, or mathematic teaching material, while English teachers contribute in translating teaching material to English. It includes providing the glossary of mathematic technical terms.

The third phase is a preventive strategy of the mathematic and language content. This strategy is similar to choosing the right strategy to teach math and English. It is conducted by giving trial of various strategies to help students understand mathematic teaching material, and prevent any strategy that could impair students understanding. The strategies that have been tried and proven successful are being recommended or mandated in the mathematic and language teaching. Finally, on the scheduled time, the assessment test is conducted.

It is clear that the student's success rate in International Mathematic Olympiad is depended on the student's teaching of English. The English courses applied in the teaching are mathematical related English. Therefore, the first strategy need to be accomplished is designing a comprehensive curriculum which includes mathematic and English competency at any required level.

THE IMPROVEMENT OF TEACHING MODEL STRATEGY

The analysis of students' work results discover that the students' inability in understanding the context of the problem lead to the inability to correctly translate the problem, which results a wrong final answer. This shows that there is a connection between student's mathematic achievement and reading ability as suggested by Cuevas (2008:138).

> Researchers have found high positive correlations (.40 to .86) between mathematics achievement and reading ability (see Aiken, 1972, for a review of this research). The ability to read mathematic in a second language is obviously influenced by a variety of language skills. Cossio (1978) found a positive correlation between mathematics achievement and second-language ability.

It also discovered that even though students understand the vocabularies and phrases, they couldn't conclude a complete meaning of the whole sentences in the math problem. Based on these facts, this part tries to overcome these obstacles. The English teacher has an important part in this context, such as:

1) Translating the problems to native language
   Olympiad labelling sometimes cause the teachers or instructor to deliver English problems to the students hastily. However, it should be noted that understanding of problems couldn't be accomplished in a short time, but needs relatively long time with clear stages. Therefore a good scheme is needed. The strategy in developing students' understanding of mathematic word problem needs to be started from their native language. Therefore, English teachers

could translate the English Olympiad mathematic word problems into their native language. The translated problems then are exercised to the students. This kind of exercise is given in the initial phase and continues throughout the course. After the observation finds that the students have already had a good understanding of math problem in their native language, the second phase is taken.

2) Composing bilingual problem
This strategy is aimed to give math problems to students in two languages: the same math problems written in English and Bahasa Indonesia. This helps students to compare the context of the problems in the two languages. The roles of English and math teachers are important, because the teachers need to explain the similarity and difference of the context of the bilingual problems. This includes explaining linguistic elements. The teachers couldn't just distribute the handouts of exercise to students and wait for them to finish. However, the teacher should guide the students to understand the problems in a whole.

3) The exercise of reading techniques
This strategy is referred to English teacher who has important role in guiding students to understand English math problem. The teacher gives questions which lead to problem understanding, similar to teaching reading comprehension in non-mathematic text. For example: (1) What are the keywords of this text? (2) What does this word mean in this context? (3) How many objects involved in this context? (4) What operational procedure used if you find this word? etc. This activity is related to the *questioning* part in scientific approach of K13. By regularly taking this practice, the students will be accustomed to try to understand problems by thinking of questions their teacher usually ask. This technique is not only could be practised by asking questions, the teacher could also ask a student to explain a problem based on his own understanding, then the teacher gives the correct explanation of the problem.

4) The guidance of transforming verbal language to mathematic notation
It has been explained that the students lack the ability to transform verbal language to mathematic notation. In this phase, students cannot be left solving problems on their own. They need to be guided step by step to transform verbal language to mathematic notation. The co-operation of math and English teachers is very important in this phase. This strategy is similar to the strategy of reading technique mentioned in number 3) above. The teacher must be actively asking questions, encouraging, and propose possible alternative: What if . . . .; What if this method . . . . Is it correct if this phrase is transformed to this?; Is it correct that this phrase denote plus symbol? . . .; etc.

5) Sufficient amount of exercise
The quote *"Practice makes perfect"* truly suites the efforts needed for students to master mathematic problem solving. This strategy is applied by providing the Olympiad's mathematic problem models as many as possible. These math problems are classified according to their characteristics so the students could understand each character of the problem quickly. This strategy will also exercise the students' ability to interpret discourse quickly.

MATERIAL BUILDING

It has been stated in Curriculum Design section that teaching material development is an important factor to help students understand discourse in international Olympiad's mathematic problem. The teaching material proposed should be related to the aim of mathematic teaching and language competency in every level. Therefore, the English and math teachers should take note of the material building principles as follows:

1) Difficulty level
   This is the main principle that needs to be considered in developing teaching or exercise material. The material should be arranged in gradation start from easy level to difficult level. The first step is the structuring the material arrangement through competence matrix. This could avoid wrong arrangement of study materials. The fatality of placing difficult material in easy level or the opposite is beyond imagination.

2) Reader friendly
   In addition to consider the difficulty rate of every level, teaching material should be designed to be reader friendly. Although mathematic is known to its complexity, it could be friendly to its reader with a good arrangement, for example, providing a glossary. Another example is the KUARK book (Science Comic). The students like this book because the display and the arrangement of the material are interesting. The fans of this book always wait for the release every month.

3) The spiral mode
   Another principle is the structured repetition or the spiral mode. The teaching material of the previous level is presented again in the next level, though in different model. This principle is like ascending the spiral stairway, you will not aware that you have reached the top. The students' competency gradually improved as the level increase. More importantly, the previous study materials are not abandoned.

4) Bilingual
   This is a very important principle to support English mathematic learning. It means that study materials are to be presented in two languages: English and the native language of the students. The first step is that the students need to be able to comprehend teaching material courses or exercises in their first language. The comprehension in their first language then transferred to the same problem comprehension in English. This strategy goes along with the notion that teaching material development in mathematic English context should be designed by relating mathematic context in the first language with mathematic context in English.

   > The development of special courses in English mathematical discourse, with particular focus on making links between mathematical discourse in the students' home language and in English. 14

   By developing bilingual study materials, the students are expected to not only knowing 'language register' and 'mathematic register' but also the mathematical terms in parallel and the influence of contexts and culture in the material or problems.

5) Per topic material
   The teaching material should be presented per topic. This method has advantages as follows: the mathematic keywords are introduced in more focussed topic. Therefore it will be easier for students to memorize them, because the keywords are used repeatedly. It also uses the spiral principle as mentioned before. The other advantage is that the students could relate the problems with the topic, along with its problem solving methods. This means the "So" effect occur: "So, if it is this kind of problems, the words mean this, and the solving method is like this".

THE APPLICATION OF SUGGESTED TEACHING MODEL

This is an important process in improving the students' problem solving skills. Teachers/instructors need to conduct the class, by maximizing their role as the facilitator of knowledge and skills. It should be noted that there is a difference between teaching and assessment. Teaching is the process of helping students in various ways to understand problems. This process is marked by the interactive communication between teachers and students, and also communication among students, while assessment is a process to determine the success rate of the teaching. This process is marked by the absent of interaction found in teaching process. The second process is a follow up of the first process. For example: after the students prepared, the teachers distribute the question sheets, then wait for the students finished their work. After the works have been collected, the teachers discus the problems with the students and give necessary reviews.

In order to help improving the English mathematic course, there are two suggested models: *pre working* and *whilst working*. The first model is shown in Figure 2, after the opening, the difficult words or the mathematic technical words are introduced to students. This model is aimed to prepare the students with the vocabulary needed to solve the problems. It is expected that the students will not face any difficulties in the level of phrases or sentences in solving the problems. The teachers could ask students who knows particular meaning in order not to give just random meaning. This method could give the chance for teachers to use *prior knowledge* of the students.

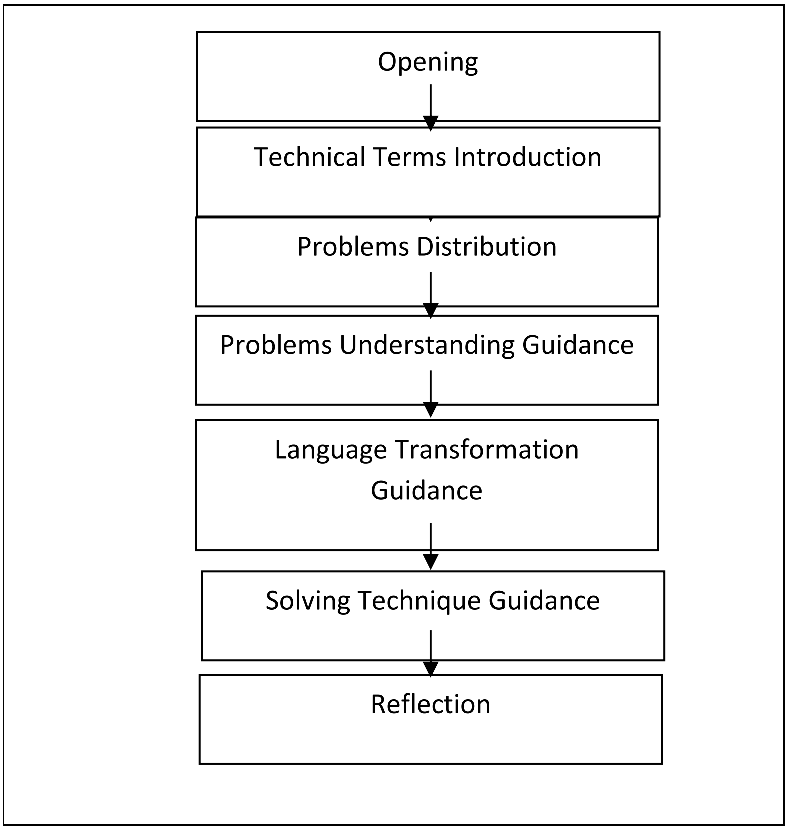

Figure 2: Teaching Model 1

In the problem understanding phase, teachers/instructors guide the students step by step until the students understand the problem. Various techniques could be implemented in this phase. For example, teachers could ask students about the meaning of the words, phrases, and sentences;

guide students to find keywords of the problems; ask the students to translate part of the problems; ask the students the overall meaning of the problems; ask the students to explain the contents of the problems; etc. The way of the teachers asking the students should be arranged systematically in order to get the students accustom to think systematically. The aim of this phase is to guide the students in understanding the whole meaning and context of the mathematic word problem.

The next phase is the verbal language transformation to mathematical notation. There are many mathematic word problems which at first glance seem don't contain any mathematic operational words. The mathematic operation is expressed in other kind of words such as in problem 6.

Problem 6
Aisyah has some candies. Every day, she eats one half remaining candies from the previous day,

The word "eats" means subtraction. Discussion about the importance of this phase and examples are provided in Teaching Model Improvement.

Another crucial point is the patient of the teachers to guide the students in finding ultimate methods of solving the problems. The students have limited ability and experience in solving mathematic problems due to their age. Therefore, they usually need a long time just to solve one mathematic problem. This will not occur in students who already know the solving technique of the problem. The example is in problem 2.

Problem 2
Find the sum of all multiples of 5 from 5 to 200.

In solving this problem, teachers should guide students to use the ultimate technique so that they could solve the problems quickly. However, what happened is much time wasted because the students don't know how to solve the problem. Actually, this is one topic of a problem in sequential sum, or arithmetic. In other words, this phase is about the understanding of mathematic concept. As shown in Table 1, there are students who understand the language aspect of the problem but don't understand mathematic concept, so they fail to solve the problem. This could be seen in problem 5 and 9. Language understanding does not assure the understanding of mathematic concept. Therefore, teachers should guide the students with the ultimate technique of solving problem.

The last phase is reflection. This activity is conducted in the end of a class. Teachers ask students to tell what they have gained during the class that day. This is useful to strengthen the materials that have been presented, and to measure the learning capacity of the students. In this occasion, teachers could inform the topic of the next meeting, also explain what students can do and prepare in their home.

The second suggested teaching model is similar to Model 1. The difference is only in the phase of Technical Terms Introduction. In Model 2, this phase is conducted after distributing the math problems as shown in Figure 3.

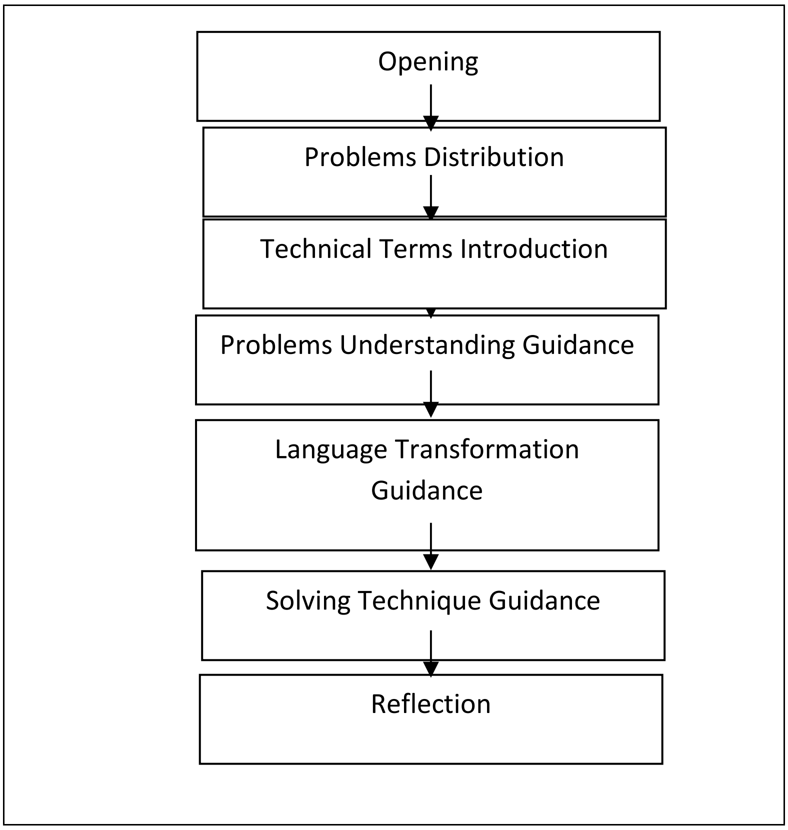

Figure 3: Teaching Model 2

CONCLUSION

The discussion above could be summarised as follows: in order to support students in international mathematic Olympiad which use English, there are four roles that should be played by English and mathematic teachers. These four things are related to each other. First, curriculum is designed to integrate mathematic and language contents, in which the language contents is configured according mathematic contents. Secondly, the teaching strategies improved with strong attention given to students' background, which acquired by: translating English problems to the native language of the students, developing bilingual problems, guiding students to improve their reading ability, guiding students in transforming verbal language to mathematical notation, and giving sufficient exercise. Thirdly, the design of teaching material needs to consider difficulty levels, interesting presentation arrangement, spiral principle application, bilingual, and per topic presentation. Finally, teaching model is conducted by applying the steps of opening, key terms introduction, problems distribution, understanding guidance, language transformation guidance, solving technique guidance, and reflection.

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