

## Language Barriers in Teaching and Understanding Mathematics: Teachers' and Students' Perceptions

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### Abstract

This study aimed to find the perception of mathematics teachers and students of MIS and CS departments toward the linguistic barriers in teaching and learning mathematics. Mathematics at the colleges and universities of Saudi Arabia is taught in English language. Students who came from high schools with low proficiency level of English language, got affected in acquiring the skills of mathematics because they developed it in their first language. In conducting this research, two tools were used for data collection. Interviews with the participant teachers from GS department and an online questionnaire shared with the participant students. According to the data results, the non-native participant teachers used translation in their classes as a useful tool to deliver the meaning to the students. However, the Saudi teacher who was interviewed clarified that using Arabic in mathematics classes is difficult. Students were encouraged to develop their English language first in order to achieve better results in mathematics.

**Keywords:** Management Information System, Computer Science, General Studies, Language Barriers, Mathematics

### INTRODUCTION

Language is a unique feature for us as human beings, and it is the first modifier of our personality, thoughts, and our creativity. In mathematics, language can be shaped into symbols, numbers, and equations. It requires knowledge beyond language. As Galileo Galilei (n.d.) attributed with the quote, "Mathematics is the language in which God has written the universe." Which emphasizes that reading mathematic is a skill. There are many studies looked at the aspect of language in mathematics. For example, a study conducted by Sarabi and Kunnathodi (2017) which highlighted different linguistics difficulties students were faced in learning mathematics. In Saudi Arabia, where English is considered a foreign language, yet this subject in colleges and universities is taught in English. Students of mathematics encounter different difficulties than regular students of language because their application and the way of communication in class is different. Which establishes a case of wondering that this research aims to answer. Are those difficulties coming from the student's low proficiency level of English language or their disability to use language in mathematics?

Since mathematics is language, students of this subject might not be aware that their ability to understand this kind of language can cause them problems. Others are aware of it, but they remain silent. Eventually, it will affect their implementation in exams and their oral participation in the classroom with the teacher.

This study is an attempt to address the perception of mathematics teachers and students about the linguistic barriers they encounter in mathematics classes.

This paper explored the answers of the following questions:

- What was the teachers' opinion toward the linguistic difficulties in mathematics?
- What was the students' conception of language barriers in learning mathematics?

## LITERATURE REVIEW

### Key Concepts

*Management Information System:* Ajayi, and Omirin (May 2007) clarified that MIS is a system focuses on the process of gathering, processing, storing, and transmitting related information to support the management operations in any organization.

*Computer Science:* As stated by the Computing Science Accreditation Board (CSAB) (n.d.), computer science is a discipline involves in the understanding and designing of computers and computational procedures.

*General Studies:* General studies are programs covers different varieties of topics and subjects. It also provides students with skills needed in their major courses (Collins English dictionary, n.d.).

*Language Barriers:* Language barriers can be illustrated as the linguistic problems in which academics encounter in their daily responsibilities at academic institutions as a teacher or researcher. These duties might include teaching, participating in a conference talks, speaking in front of public, or any other oral or written activity (Landa, 2006).

*Mathematics:* Courant and Robbins (1996) pointed out that mathematics is an expression reveals the active will of human mind. Along with the contemplative reason and aesthetic perfection desire. The fundamental aspects for mathematics are logic, intuition, analysis, and construction generality and individuality.

### Previous Studies

The first systematic study performed in (May 2017) by Kunnathodi and Sarabi at Kerala, India. Carried out the impact of linguistic challenges on the attitude of upper primary students of mathematics. The researchers collected data from 200 Indian students (90 boys and 110 girls) chosen randomly from upper primary schools of Kozhikode and Malappuram districts of Kerala. Chi-square test containing 21 areas of difficulties used by the researchers. First, students ranked their likes or dislikes toward mathematics learning in 3-point scale. Then, categorized in chi-square analysis. The test divided into 6 tables according to difficulty type. First table covers the difficulties in mathematics terms like math terminology, geometric terms, writing numbers in word names and words to numerals. Second table related to difficulties in mathematics symbols. Also, table

associated with morphology of mathematics language followed with a table covers the syntax of mathematics such as translating algebraic expressions to phrases. Along with a table discussed the difficulties in semantics of mathematics such as word meaning in specific context. The last table showed barriers in pragmatics of mathematics language like word problems and reading geometric diagrams. The data of Kunnathodi and Sarabi had revealed that students' attitude to mathematics learning was strongly influenced by the difficulties of terminology, pragmatics, syntactic principles, and symbols. Additionally, they reached to a conclusion that difficulties and low of understanding increased with the students' attitudes of aversion.

The second study was an article organized by Mary (2007) at University of Michigan, United States of America. This article amalgamated several researches done by many applied linguists and mathematician educators. The article highlighted the language impediments in mathematics and pedagogical practices were suggested to help learners in classrooms. The researcher explicated that the challenges for many students were simply the different usage of linguistic structures in our everyday life and in mathematics. Areas underscored in the research involved multiple semiotic system of this subject such as visual representations like graphs or diagrams beside written and oral language. Furthermore, the researcher pointed out that the technical vocabulary or mathematic registers are used totally different from the normal use in our everyday language. For example, times, borrow, product, and place which emphasized the need for students to move from their everyday simple language to more technical one in order to accomplish a successful interpretation of mathematical expressions. The solutions suggested by the researcher were mainly focused with classroom practices by teachers and students. Good oral explanation and engaging in a discussion about how mathematic language is constructed can increase the awareness of students, so they can pay attention to the factors that may affect their progress in this field.

The current research is different from the two previous ones. The first study was conducted in India with 200 mix gender participants chosen randomly from two different upper primary schools. Also, a test was used to measure the students' attitudes. The second study was a qualitative study performed in United States of America that analyzed lots of resources done in the same field by linguists and mathematicians. This paper was conducted at Yanbu University College, Yanbu Industrial, Saudi Arabia. The scope of this paper draws its attention to the perception of female Saudi students from CS and MIS department along with three non-native Arabic teachers of mathematics and one Saudi teacher from GS departments. This paper featured their opinion toward the language barriers in teaching and understanding mathematics. However, data collection tools were different. The researcher did not use a test to identify the students' weaknesses and attitudes. Instead, the researcher used an online questionnaire for students in addition to interviews with teachers for further information.

## **METHODOLOGY**

This section describes the type of the research, research tools, participants, and the data collection procedure.

## **Research Design**

This study was a mix method study about the perception of mathematics teachers and students toward the linguistic difficulties in teaching and understanding mathematics. The qualitative data gathered from the interview answers by the teachers. While the quantitative data measured from the online questionnaire that was given to the participant students.

## **Participants**

The participants of this research were four female teachers and 25 students from YUC at Yanbu Industrial City, Saudi Arabia. The students were from MIS and CS department between 19 to 25 years old with Arabic as their first language, and different levels of English proficiency. Besides, three non- native Arabic teachers and one teacher was native-Arabic.

## **Instruments**

### ***Interview***

The interview designed by the researcher for mathematics teachers. The researcher met 4 mathematics teachers from GS department. The interview was a semi- structured type allowing the diversity of answers and ideas of questions to be added according to the interviewee's sayings. Three were non-native Arabic teachers, and one was native-Arabic teacher. The interview accentuated the teachers' point of view regarding the communication and linguistics barriers they encountered in classes with students and the possible reasons for those difficulties. The researcher was able to record three interviews with participant teacher's permission, but one teacher was not willing to record, so the research took notes for her answers. The analyzing of the interview answers was by listening to the recorded interviews along with reformulating the note taking answers by the teacher who refused to record. Also, teachers were asked about if they believe that English proficiency level had to do with the student's misunderstanding of mathematical language. In addition, the researcher asked whether they have undergone such a situation where communication had affected by factors related to language ability (see Appendix A for the list of interview questions).

### ***Questionnaire***

An online questionnaire designed by the researcher in English language and shared among MIS and CS students. Eight questions presented in the questionnaire diverse with multiple choices and one paragraph answer. The questions were designed to know the student's perspective upon the possibility whether their Standing if English language affect their understanding of mathematics. Moreover, preferences whether they want to study mathematics with Arabic or non-Arabic teacher with possible reasons for each. Also, yes/no question describe the students' opinion about if they believe that their English proficiency level may affected the way they understand math. Furthermore, a paragraph answer asking the students to explain a situation where they cannot understand the teacher's mathematical instructions. Finally, a close-ended question

asking about their perspective on consideration of these linguistic barriers by teachers (see appendix B for the list of the questionnaire items)

## **Procedure**

This study used two different data collection methods. First, the researcher designed an online questionnaire and shared it among 25 students from MIS and CS department at YUC. Then, the researcher arranged with the participants teachers the time for the interview through e-mail messages. Finally, the researcher analyzed the questionnaire responses and the recorded interview answers.

## **RESULTS AND DISCUSSION**

This section presents the analyses of the data collection tools and the analysis of the findings. The interview was answered the first research question: what the teachers' opinion toward the linguistic difficulties in mathematics? The questionnaire aimed to know the students' conception of the language barriers in learning mathematics.

### **Data analysis of the interview**

The participants teachers shared insights and situations they faced personally with students in the classroom. The first participant teacher was non-native Arabic speaker stated that teaching mathematics is basically relying on using the language. If that language was unclear and vague, students could not be able to analyse and interpret math equations. Also, she clarified that most of the difficulties are faced by foundation and freshmen level students where their English language skills is not completely developed. By the time, students can manage these difficulties and be able to solve them. Foreign teachers of mathematics frequently used translation in their lectures. After they finished the lesson, they asked a student to translate and link between English mathematical terms with Arabic.

Additionally, some students were unable to express themselves orally correct, so the student expressed what she wanted in Arabic and other student helped her to say it in English. Which took time and effort and affect the class fluency. As a solution to this problem, foreign teachers asked another mathematical teacher who is native-Arabic to give her the Arabic equivalents for some mathematical expressions in order to write it on the board before the lesson started, so students got the idea of what the lecture was really about. Mathematics does not only have numbers and symbols it has word problems. Listening and reading ability matters in math classes. The participant teacher added that some students could not be able to figure out what the question requirements are because the words remain in their eyes with no good reading ability to complete the task. Moreover, she added that our focus as teachers had shifted from building mathematical skills to student to help students understand what mathematics is.

The reason for all these difficulties is due to the first development of mathematical skills for students in different language which is Arabic language. When they come to college level where this subject is totally in English, they do not understand it. Students need to relate English language with mathematics. Moreover, one of the obstacles faced by students of math was pronouncing formulas that named after different mathematician,

and some are in French such as L'Hôpital's rule and pronounced [lopital] in French, but students pronounce it (hospital) which gives different meaning because of the influence of their English. The second participant teacher was also non-Arabic native speaker who agreed with the statement that the comprehension of math gets affected by the English competence of the students. For many reasons this idea was supported, for example, teaching math with terms that students are not familiar with will affect their understanding.

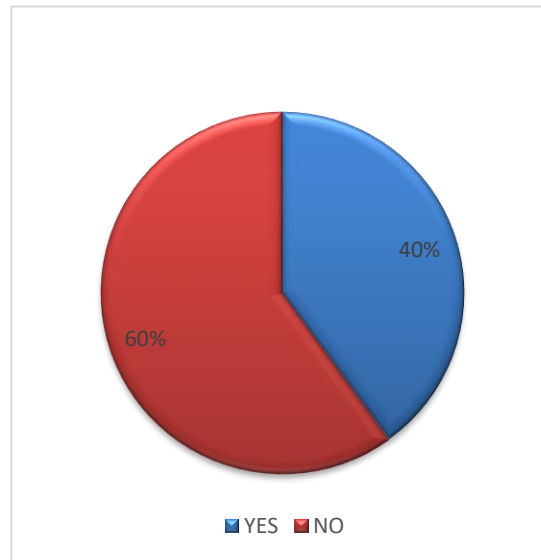
Also, solving a mathematical problem requires steps like comprehension of the problem given in the question, analysing and knowing the steps needed to solve the problem. This kind of barriers arise with high level students because the material is more complex than low level students. The next participants teacher is also non-Arabic native speaker had also agreed on the first statement by claiming that students come to this level of education with background of Arabic language where math is taught in English. It is very common that learners will get affected by something presented to them in different language than their own one. Moreover, students will need repetitive drills to comprehend and master mathematical skills. The last participant teacher was Arabic native speaker who had a different perspective since she shared the same mother tongue with the students. First, she agreed that the students' competence of English language does affect their understanding of mathematics. However, she added that she does not prefer to use Arabic while she explains lectures. She found it difficult since she studied and had a bachelor's degree of English mathematics, but students sometimes insist using Arabic in class communication where it is an easy way to understand the lessons.

### **Data analysis of the questionnaire**

The questionnaire findings supported and manifested the research question clearly. The designing of the questionnaire contained 8 questions divers between multiple choices and one open ended question. 25 randomly subjects from MIS and CS responded the questionnaire. First a yes/no question featured the opinion of the students whether they believed that their English competence level affected their understanding of mathematics or not. 32% responded with yes, and 28% of them never thought that their English competence has to do with their comprehension of this subject. The rest of the participants which makes up 40% of the students had an average thought that maybe their level of English did affect their learning process of math.

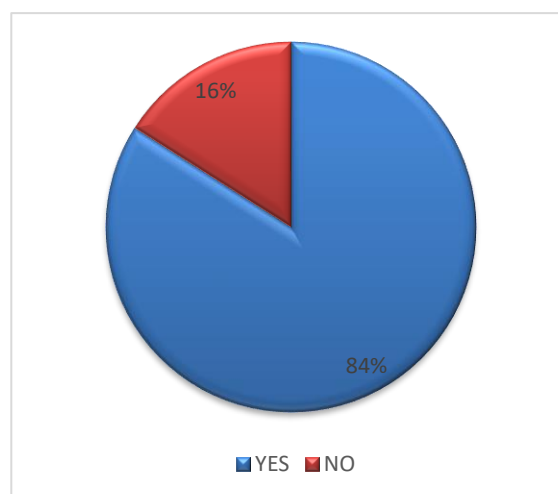
In response to question 2, asking about if they have come into a situation where they could not understand the teacher's oral explanation. Almost all the students did not encounter any situation in classes. The researcher believed that, this is due to the students' full dependence on translation with no noticeable effort to improve mathematical skills in the target language. Very view students had faced this kind of difficulties in class communication. Which they shared in the third question that emphasized the description of situations they encountered in class. One of the participants shared her experience. The teacher explained a topic that represented the term "integration". She clarified in her answer that it was the first time for her to hear this term, and it took her some time to understand the lesson. Another participant shared her opinion she said, "explaining mathematics and listening to the teacher was hard in the

beginning, and it took some time till the student adjusted in this kind of language". The next question highlighted the students' preferences in taking a mathematic course with native-Arabic teacher.



**Figure 1.** Percentage of student's preferences to study mathematics with Arabic native speaker

Figure 1 shows that 60% of the participants preferred not to take math with native Arabic teachers and only 40% of them felt that it is easier to communicate, and it feels comfortable more with native-Arabic teacher.



**Figure 2.** Percentage of students' preferences toward studying mathematics with non-native Arabic speaker

Figure 2 shows that, most of the students preferred to take math with non-native Arabic teachers, and only 16% of students liked the opposite. The overall responses to the two questions were unexpected. The researcher thought completely the opposite. Perhaps students of MIS and CS major wanted to develop themselves mathematically with non-native Arabic teachers. Where they force to use English in class rather than feel more flexible with teachers share their native language. Finally, the last question was a statement to know the students' perception "Do you agree that the language difficulties

of mathematics which students may face in classrooms should be taken in consideration by teachers?”. Almost all the students agreed with the statement.

According to questionnaire responses, students of MIS and CS major have different perspective upon the linguistics boundaries in mathematics. Maybe this kind of obstacle never came up into their mind, or even it may cause them mis implementation in exams. Eventually, students should increase their awareness toward this aspect of mathematics as they all agreed that this obstacle should be under consideration by educators.

The results of the two previous data collection tools was answered the two research questions that this research aimed to explore. The interviews answered the first research question “What was the teachers’ opinion toward the linguistics difficulties in mathematics?”. Besides, the questionnaire’s responses were answered the second research question “What was the students’ conception of the language barriers in learning mathematics?”.

The findings of this research were supported by a similar study conducted in India by Sarabi and Kunnathodi (2017). Their study carried out the influence of linguistic challenges on the attitude of the mathematics learners. Most students faced difficulties in the terminology of this subject and their language background affected their implementation and performance as well.

## **CONCLUSION**

Language and mathematics can be different but related and influence each other. Mathematics is a subject where many fields of science joined. This research purposed to highlight the opinion of the participants teachers and students upon the language difficulties in mathematics. Based on the results, students had different believes toward the linguistic difficulties in mathematics. Their English proficiency level is affecting their understanding of mathematics. According to the participant teachers’ views these difficulties arise due to different reasons such as the language background of the students, lack of concentration, rely on receiving information through translation, and difficulties in analyzing word problems given in the questions. Being a mathematics student requires the knowledge in the language that is being used in order to communicate, and the mental skills that is needed to perform better.

In the process of this research, some limitations were emerged. The number of the participant students was less than researcher’s expectations. Also, the number of the participant teachers was hoped to be more than four.

For Arab researchers of linguistics, further studies are needed in this topic especially targeting the learners of English as a foreign a language. This kind of topic is rarely discussed in our region. As researchers, we need to bring those insights of difficulties to the students and teachers in order to raise the awareness of the language impact on mathematics. The results of this research encourage to design a technical course about mathematics vocabulary in the syllabus designing for MIS and CS majors.



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## APPENDIX A – INTERVIEW QUESTIONS

1. Do you think that the language proficiency level of the students affects their understanding of mathematics?
2. In what way you see your students face difficulties in this subject?
3. As a teacher, have you encounter any communication barriers between you and your students when explain math problems?
4. Do you think your students aware of these linguistic difficulties in this subject?
5. Do you use Arabic language or translation in your classes?

## APPENDIX B - QUESTIONNAIRE

1. Does your English proficiency level affect the way you understand mathematics?  
\* Yes                      \* No                      \*Maybe
2. Have you ever been in a situation where you do not understand the teachers' explanation?  
\*Yes                      \* No
3. Can you describe this situation?

.....

4. Do you prefer studying mathematics with Arabic native speaker?  
\* Yes                      \* No
5. If your answer is "Yes" is it because of the following:  
\* Easier to communicate                      \* Get marks easily                      \* I feel more comfortable
6. Do you prefer studying mathematics with non- native Arabic speaker?  
\* Yes                      \* No
7. If your answer is "No" is it because of the following:  
\* I do not feel comfortable                      \* I cannot understand her accent                      \* I found it difficult to communicate with math in class
8. Do you agree that the language difficulties of mathematics which students may face in classrooms should be taken in consideration by teachers?  
\* Agree                      \* Disagree