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To cite this article: S Shaumiwaty *et al* 2020 *J. Phys.: Conf. Ser.* **1663** 012066

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Teacher performance toward students' mathematical literacy in teaching linear program mathematical models

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Abstract. The teaching technique is essential to reach students' literacy goals in learning. This study discussed the teachers' role in teaching math toward the students' mathematical literacy in teaching linear program mathematical models. The focus of research is to determine patterns of teachers' performance in teaching math in the classroom. The ethnography method was applied in this study. Besides, to find out the pattern of the teachers' performance, the anthropological approach was used. The pattern of performance is essential data that can describe the phenomena of speaking activities related to mathematical literacy. With the discovery of the teachers' performance, it can be seen how to apply the teaching model in the next effective teaching and learning process. Research data were video recordings, in-depth interviews, and participatory observation. The results showed that the performance of math teachers in learning mathematics was teaching and examining. They were represented through statement and command language function dominantly instead of question and offer. Statements were encoded with declarative sentences, and command encoded in imperative sentences. Consequently, it affected the low level of student math literacy due to strict learning performance and lack of education part as one of literacy students' requirements.

1. Introduction

Literacy ability influences the process of acceptance in learning. The current definition of literacy extends to multiple skills, such as understanding, communicating, thinking, connecting, and problem-solving [1]. Mathematical literacy is an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes mathematical reasoning and using mathematical concepts, procedures, facts, and tools to describe explain, and predict phenomena. Besides helping people to identify and understand the role of mathematics plays in the world, mathematical literacy also deals with making the well-founded judgments and decisions required in life by constructive, engaged, and reflective citizens [2].

Improving students' mathematical literacy skills is also influenced by teacher competence, both academically and pedagogically. Teachers are required to provide opportunities for students to build



their knowledge and appreciate the relationship of mathematics with their lives due to understanding. As mathematics is essential knowledge, its application is also used in almost all branches of science. In Indonesia school, mathematics is one of the knowledge that should be mastered by all students. The goal is to make students use mathematics as a tool to understand daily life [3]. The ability to use concepts in life is part of mathematical literacy competencies.

To fix students' scores, most schools in Medan gave remedial to their students. The teachers' significant action after their diagnosis was remedial in the form of re-teaching [4]. Besides, many teachers also perform drills and practices to overcome students' learning difficulties. He also added that developing teaching strategies and media that fit students' learning difficulties was a minor action. In this study, researchers believe that before applying models, methods, and learning techniques, it is essential to know the conditions and character of teachers and students. The determine the situation, teachers and students' performance needs to be considered to get information about students' literacy abilities. Linear program mathematical models are an essential topic to learn because this model can apply in daily life activity. Besides, this topic always appears in national examination and also in university test questions entrance. The linear mathematics program is a part of mathematics in problem-solving, maximizing, or minimizing a linear function that depends on linear boundaries. Mathematical models are a simple way to translate a problem into mathematical language by using equations, inequalities, or functions.

This study focused on mathematics teacher performance on students' mathematical literacy abilities in learning linear program mathematical models. Understanding could inform the conditions of learning in the classroom and the patterns of the teacher [5]. Performance research is crucial because it describes the appearance of a speech production that can be seen and observed. The performance is a valid custom and becomes a standard form, which is the data for evaluating and knowing the learning method for the next. For example, in teaching mathematics, many researchers have applied methods, techniques, and learning models, but ignored and consider teachers' performance. Performance is an important thing to know because it is included in the initial steps before applying teaching methods/techniques and evaluation for future teaching.

Mathematics is essential knowledge, and its application is used in almost all branches of science. The ability of mathematical literacy helps humans to understand the role and usefulness of mathematics in life and can be used to make correct decisions as educated humans [6]. In Indonesia education, Mathematics is one of the knowledge that should be mastered by all students. The purpose of this mastery is to make students use Mathematics as a tool to understand daily life. The situation of the speech transition occurring between the teacher and students and between students and students during the learning process in the classroom affects students' understanding of learning. The application of student-centered learning may be successful in some places but not necessarily in other areas. Several things must be considered before implementing student-centered because related to their behavior. In western countries, they allow students to interrupt, interrupt, or ask questions while the teacher is teaching; indeed, it will not cause problems when it happens.

Nevertheless, in eastern countries, interrupting the teacher who is speaking while teaching is an action that is contrary to the ethics and norms adopted for interrupting older people when speaking is considered to be impolite. It means some characters and conditions must be had before applying a method/technique. It needs to be considered so that the application of learning methods/processes can run well when wanting to use student-centered conditions.

For this reason, performance research on learning is carried out to describe the math teacher's performance toward student literacy in the learning process at class meetings. Performance in the concept of this research is a shifting or turn-taking activity that occurs in the learning process at a formal (class) meeting. Duranti [7] states that performance is a dimension of speech with good grammatical roots. It is demonstrated through work on deixis and metalinguistic or metapragmatic frames. To obtain the form, which is the performance contained in it, the anthropolinguistic approach is used because utterance is closely related to the behavior of the speaker. In anthropolinguistics, to

find out a performance, the components in it, which include text, co-texts, and context, can provide the meaning of the version.

The anthropological approach is used to examine the math teacher's performance toward student literacy. This study concerned the math teacher's interpretation of student literacy patterns formed as characters of learning mathematics in the classroom.

2. Methods

This research was conducted at High Schools in Medan, North Sumatra Province, Indonesia. In this study, the principal and author are mathematics teachers because they were a representative of the institution to teach the material and be responsible for learning outcomes. Likewise, the author was also a teacher with the characteristics of mastering the class by creating teaching conditions. At the same time, animators are mathematics teachers and students as speakers or speech producers. Speakers filled all three roles, but they do not have to do it either, and they did it simultaneously [8]—data in the form of text conversations, in-depth interviews, and observation. The conversation text was taken from several meetings in class. Interviews were conducted separately to find out the meaning of the utterances produced by students during class meetings. Observations were made to complete the text and interview data.

The data were analyzed through domain analysis, taxonomy analysis, and componential analysis to get characteristics of teachers' performance. Domain analysis explained the semantic relationship between teachers' performance toward students' math literacy. Taxonomy analysis classified performance through language codes. The componential analysis confirmed and showed contrast among classification. As a result, the pattern of teachers' performance was found. The anthropological approach was used as a core to see the design and meaning of all utterances to discuss the language produced.

3. Result and discussion

Mathematics is essential, and the basic foundation knowledge to solve the problems of daily life [9][10]. In teaching mathematics, the goal to be achieved is that students' ability to understand the lesson and its application in daily life. The mathematical literacy domain is concerned with the capacities of students to analyze, reason, and communicate ideas effectively as they pose, formulate, solve and interpret mathematics in a variety of situations [11]. The domain of mathematical literacy deals with the ability of students to analyze, think, and communicate ideas effectively as they propose, formulate, solve, and interpret mathematics in a variety of situations. That was, the ability of mathematical literacy will be obtained if students already have the ability, as mentioned above earlier. In this study, instructors must also have the ability to achieve students' ability to analyze, think, and communicate ideas effectively as they propose, formulate, solve and interpret mathematics in a variety of situations.

There were six meetings in this study, which are two meetings were held by providing information about things that began with the introduction, the learning objectives to be achieved in the semester, and the structure of the presentation. At these two meetings, the type of design conducted was that the lecturer spoke dominantly to explain. An explanation of the kind of performer structure is presented based on three analyzes, which include domain analysis, taxonomic analysis, and component analysis, to get the characterized participation formalized.

3.1. Domain analysis

In this study, the domain is performance as a type of account and performance as part of the performance. The analysis domain diagram can be seen in figure 1. The first step to describe teachers' performance in teaching math, the semantic relationship that able to show the effect of students' math literacy was cause-effect. It was taken to make clear the situation in the classroom during the teaching-learning process.

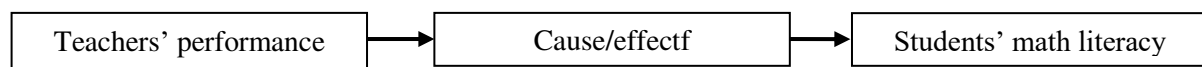


Figure 1. Domain analysis between teachers' performance and students' math literacy in learning.

3.2. Taxonomic analysis

The next step was to classify the performance occurred based on text, co-text, and context. Interactions occur both between students and teachers and between fellow students if they have difficulties such as not understanding the questions or just convincing that what they know the same as their peers. The same situation also occurs when writing assignments are given. For performance classifications, the division based on taxonomic analysis can be seen in the following figure 2.

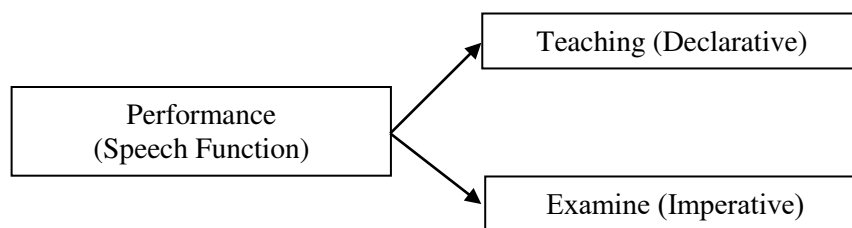


Figure 2. Taxonomic analysis of the math teacher's performance in the classroom.

In figure 2, the language used in teaching was teaching and examine performance. The teaching performance was encoded in declarative sentences. They always occurred when the teacher explains the lesson of every topic from the textbooks. The example of declarative sentences can be seen in table 1.

From table 1, there were two examples of declarative sentences delivered by teachers when they began to introduce the topic to the student. Mostly, they just read the sentence from the textbook or repeated the sentence from the book to be written by students as an important note about the topic. The declarative sentence was also used when the teacher explained the example of tasks related to the topic. Then after the teachers taught several statements and assignments, students were asked to do some exercise. Sometimes, if they were not able to finish them all, they could take it as homework. Then, the imperative sentence would be occurred in examining students' work. It can see as in table 2.

The example question of linear program mathematical models in table two has to be solved by making a table, mathematic model, equation function, and the set of solutions for the inequality. The steps of the solution to this question can be seen in figure 3.

Table 1. The performance of using a declarative sentence in teaching the lesson.

Text	Language code
<i>Program linier adalah bagian dari matematika berupa pemecahan masalah pengoptimalan, yang memaksimalkan/meminimumkan suatu fungsi linier yang bergantung pada kendala (batasan) linier. Kendala bisa SplDV/SpelDV.</i> (Linear programming is a part of mathematics in the form of optimization problem solving, which maximizes/minimizes a linear function that depends on linear constraints. The constraints can be SplDV/SpelDV)	Declarative
<i>Model matematika adalah suatu cara sederhana untuk menerjemahkan suatu masalah ke dalam Bahasa matematika dengan menggunakan persamaan, pertidaksamaan, atau fungsi.</i> (Mathematical models are a simple way to translate a problem into the mathematical language using equations, inequalities, or functions)	Declarative

Table 2. The performance of using the imperative sentence in asking and examining students' work.

Text	Language code
<p><i>Seorang pedagang merencanakan membuat 2 jenis kue. Sebuah kue jenis pertama memerlukan 250 gram tepung, 200 gram gula dan 200 gram telur. Sedangkan sebuah kue jenis kedua memerlukan 250 gram tepung, 150 gram gula, dan 250 gram telur. Bahan yang tersedia 8,5 kg tepung, 6 kg gula, 8 kg telur. Harga kue jenis I Rp 5000,- dan sebuah kue jenis II Rp 6000. Berapa banyak kue I dan II harus dia buat agar mendapat laba sebesar-besarnya?</i></p> <p>(A seller plans to make two types of cakes. The first type of cake requires 250 grams of flour, 200 grams of sugar, and 200 grams of eggs. Meanwhile, the second type of cake requires 250 grams of flour, 150 grams of sugar, and 250 grams of eggs. The available ingredients are 8.5 kg of flour, 6 kg of sugar, 8 kg of eggs. The price for a type I cake is IDR 5,000, and a type II cake costs IDR 6,000. How many cakes I and II must the seller make to get the maximum profit?)</p>	Imperative
<p><i>Tempat parkir seluas 600 meter persegi hanya mampu menampung 58 sedan dan bus. Tiap sedan membutuhkan tempat 6m² dan tiap bus membutuhkan tempat 24m². Tentukan model matematika dari permasalahan tersebut!, Tentukan Hp!, nilai max, apabila sedan 2000 dan bus 3000.</i></p> <p>(The 600 square meter parking space can only accommodate 58 sedans and buses. Each sedan requires 6m² of space, and each bus takes 24m² of space. Determine the mathematical model of the problem! Determine the set of the solution! The max value, if the sedan is 2000 and the bus is 3000)</p>	Imperative

Figure 3 shows the linear program mathematical model solution procedure also completed by making the number line to show the set of solutions. It can be seen clearly from the part without shading. The word and phrase written boldly in table 2 had the imperative meaning. Even though the first example seems like interrogative sentences, the purpose of the whole text was a command. The teacher asked students to answer the question not to get the information (as in an interrogative sentence) but more to examine them to determine if they were able to do the task. Unfortunately, there was a perception that if all students submit their task means, they were able to understand the topic. From interviewing some students, they told the situation after the teacher explained a lesson and gave the task, only several students (sometimes two or five students) who did the task in their paper and gave the paper to the teacher. After that, they taught their friends to do the task. The funniest thing was if all of the students did not understand, the smartest would ask the teacher as his effort. But if it was not working, they waited until the bell rang and brought the task as their homework. What happened after that was very sad, but as teachers, we also proud of the students because they have the effort to do the task at full day time (extra time after school).

From interviewing teachers, we asked them to describe how they teach their students. Similar to the students' description, the teacher entered the class, greeting them, asked the students to collect their homework (if there was homework), and then checked the students' presence and started the lesson. When we asked about the method or teaching technique, they mention several techniques in their lesson plan, but actually, the method or techniques never been applied. They also never evaluate their teaching performance for several reasons. From this situation, it can be seen that teacher performance in the classroom only has little impact on their literacy.

Teaching is not merely about teach the lesson but also educate students. Educate covers training, encouraging, and be a model for their students. Teaching is not easy, but it is essential and can be valuable when we see improvements from our students and know that we have a role in making it happen [12]. Learning and students can indeed be difficult and stressful for a time, but it is also worth remembering that doing the best teaching can also be very enjoyable. Considering other things besides

teachings, such as knowing the character of students and their performance patterns, was a supporting factor in teaching success.

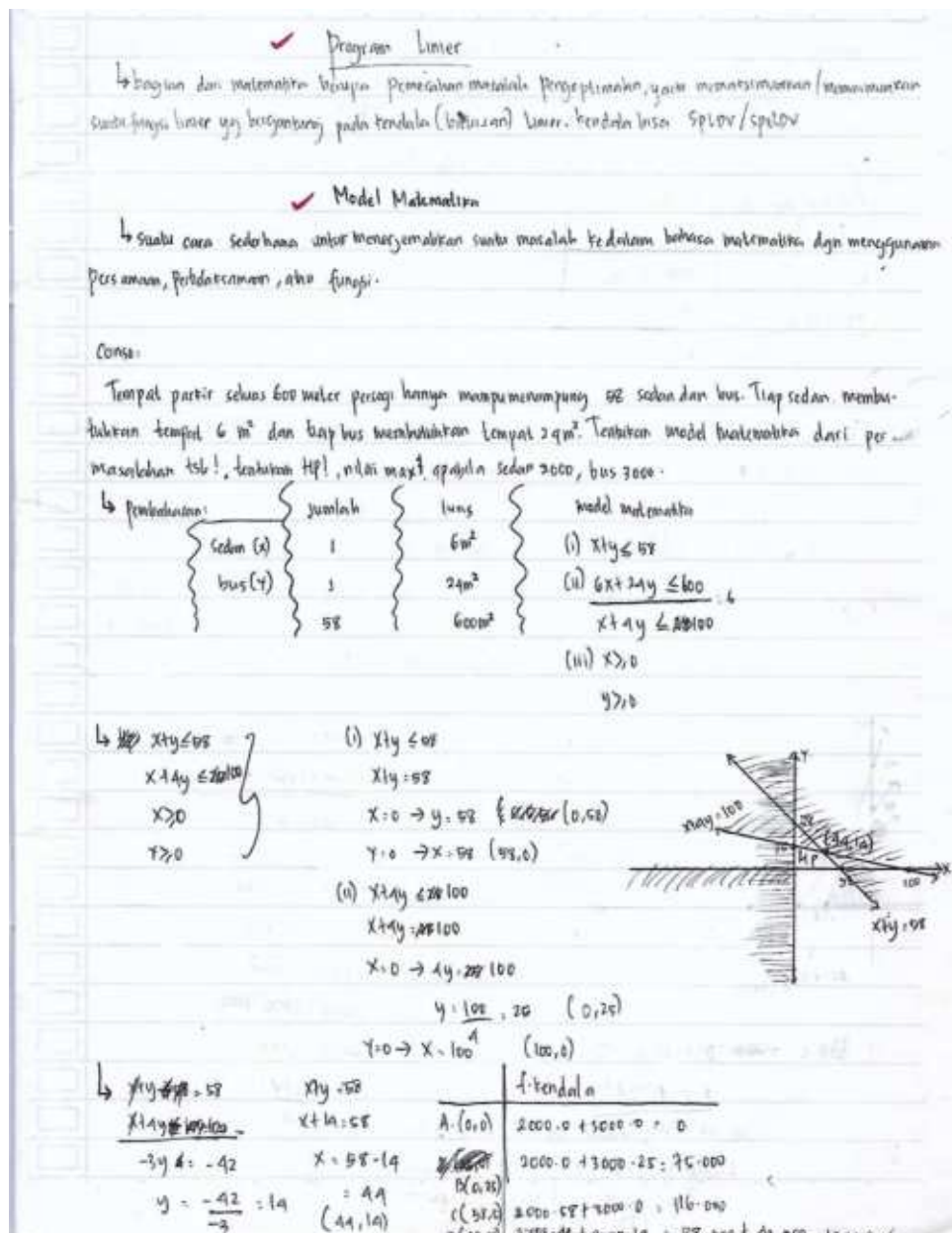


Figure 3. Linear program mathematical model solution procedure.

Teachers, as performers, played a central role in building the education situation in the classroom. Performers based on the participation framework proposed by Goffman in [7] stated that the principal position played by the teacher as the party responsible for the message delivered. For the author, the position is done by the teacher and students, but in this process, the teacher was more dominant in controlling the condition (framing). Bateson in [7] introduced the term "frames" as a part of the discourse. It marked that in the case of listener and speaker who understand each other utterances, and both must be aware of the context in question. When the speaker and the listener are in a conversation and do not share a related framework, misunderstandings and misinterpretations often arise. From this

situation, it can be explained that the teacher was the principal responsible for the condition of learning comfort. For that, as a principal, a teacher must take full responsibility in building students' literacy.

Math not only consists of a numerical problem but also the word problems. Especially for word problems, it is essential to build students' language literacy so that they able to understand the problem first. It is expected that in solving word problems, the way students use their essential mathematical competencies is supported together with their methods of using language literacy [13]. Teachers should teach innovatively from time to time to make an exciting nuance in learning. Besides teaching conventionally, one teacher used in focus to play a video for the lesson at that time. She played the video first, and then students were asked to watch the video. After that, the teachers' repeated the video but in a cut, version to explain the lesson slower.

Playing a video for a lesson is one technique from the teachers to teach students in the classroom. It was such a good idea, but students got bored because students over and over were introduced with the same technique. Meanwhile, teaching and educating should be applied together to get a holistic description of students' cognitive. From observation, teachers used explaining and examining during teaching. The performance noted teachers' verbal and nonverbal. For verbally, it was reported by transcribing the utterances. Multimodal involves body movements, facial expressions, and gazes, as well as gestures. For this reason, through text data confirmed by interviews and observations, it can be found that the utterances conveyed do not always match their meaning with the performance displayed.

The performance of the teachers affects students' attitudes in learning. Researchers found that negative attitudes, such as testing or ridiculing, can affect students' ability to learn. Thus, teachers must not only teach but also build the motivation and courage of their students to speaking. They admit that somewhat disturbed by uncovering what might be seen as a superficiality in a significant part of teachers' reasoning about the use of real-world problems [14]. In math, a negative attitude can be seen in the students' favorite answer "no" for teachers' favorite question is "any question?". No, in that situation, had several meanings. First, no means I did not understand at all, so my answer is no. Second, no means I know partially, but I did not understand the further explanation. For the first and the second answer, the reason was done to saving face from their friends. The third, no means I ignored the description because I am not too fond of math. It is difficult and makes me dizzy. The reason to answer no only to show that the students responsible for the teacher's question. The meaning of the answer showed various categories of responses.

Responding to the performance conditions of mathematics, teachers must adjust the percentage between three essential things done in teaching, namely providing understanding, motivating, and providing material. Instruction not only includes learning material but also considers other matters related to delivering the material. Mathematics literacy is the knowledge to know and apply basic mathematics in our everyday life [15].

4. Conclusion

Based on the research results, it can be concluded that the performance of mathematics teachers in teaching-learning linear program mathematical models was teaching and examining performance. Teaching performance was found when explaining the material, and reviewing performance was when telling to do the tasks and homework. The lack of performance education affected the lack of students' achievement related to literacy. Consequently, students' literacy in learning math was low. It is suggested to do brainstorming to get students' attention before the lesson gets started. Further, teachers should do evaluations related to their performance so they will be able to conduct an appropriate method or technique in teaching math and achieve the learning objective toward students' literacy.

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