
Story Problem for Low-Grade Primary Students: Discourse Analysis

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Abstract: Story problem is the type of math problems presented by the media of language and story. This study was done to identify the type of discourse structure of the story problem in mathematics textbooks for low-grade student in primary school. The focus of study is viewed from the number of components and the type of the integration of those components. There are three components in the story problems, namely introduction, events, and question component. Nine mathematics textbooks of 1th, 2nd, and 3rd were taken as sample with three books for each grade. The study result about the number of components composing story problems also shows that most of story problems for primary one, two, and three-grade consist of three components. The others are story problems with only two components by omitting the first component which is the introduction component. Viewed from the components integration type, result shows that story problems components that are combined for primary two and three are the introduction and events components or the events and question components. The integration between introduction component and events component is indicated by the conjunction “and”, “while/whereas”, and a comma. The integration between events and question component is indicated by the conjunction “if”. It will all produce complex sentences. The conclusion of this study is that, viewed from their discourse structure, most story problems for primary one and two students are relatively shorter than three, by omitting the setting and character element in introduction. It implies that there is no introduction part to introduce the context or narrative elements whose function is to connect the real world and mathematics.

Keywords: story problem, discourse analysis, low-grade, primary school

1. INTRODUCTION

If in the Netherlands applied approach Realistics Mathematics Education (RME) in the learning of mathematics in elementary school, in Indonesia applied approach to learning Indonesian Realistic Mathematics, which presents the material mathematical close to everyday life (Kementrian Pendidikan Nasional, 2007: 3). It was realized in the story problem because according to history, that problem was held with the aim of connecting mathematics to the real world, and the story as a bridge (Thomas & Gerofsky, 2007: 22).

As a discourse, story problem has a different genre to another discourse. In that discourse not only contained linguistic symbols, but also mathematical symbols. Therefore, by Sarukkai (2001) about the story calls the discourse with non-linguistic symbols and categorized as a unique discourse. The mathematical symbols are in three parts or components which include the introduction, event, and all of the questions. Ideally in a story problem contained three components with a linear or sequential positions, but some story problems in mathematics text books do not meet these criteria. In fact, Gerofsky’ research faound that if asked to make about the story, the students will make the ideal pattern, which contains three components complete with the position of the component in a

linear sequence (2006). It shows about the story in textbooks, especially for elementary school students about the components should contain a complete and with a linear sequence of components. Therefore, this study aimed to identify the discourse about the story in textbooks of Mathematics for students in grade 1, 2, and 3 primary schools based on (1) the number of components and (2) the type of discourse structure based on the position of its components.

According Verschaffel, Greer, & de Corte (2000), the components of the story problems have different functions. Components of the introduction serves to give context. So, these components contain narrative elements, such as setting the time and place, is also an actor and his role. Events component serves to give instructions with regard to semantic structure (addition, subtraction, multiplication, or division). The function is the question component provides confirmation of the semantic structure and mathematical symbols are referred to in the matter. The position of the three components can be seen in the example below.

One day Jerry left camp on his motorcycle to go to the village. Ten minute later Jake decided to go too. (Introduction component) Jerry was travelling 30 mph

and Jake traveled 35 mph (event component). How long before Jake caught with Jerry? (Question component)

In general, three components realized in the construction of syntactically different so in a discourse there are at least three construction syntactic. However, teacher and creator of the story problems often do not look important the introduction component, so that sometimes omitted because these components are considered not to be part of the equation math. In fact, these elements can clarify the realization of the application of mathematics in the real world.

Viewing from the parts of quantity in a mathematical equation, occupying an introduction component contains the first quantity, the event component contains the second quantity, while the question component contain the third quantity that should be calculated. This is consistent with Zan (2010) which states that the introduction component is part of a preliminary matter that describes the quantity of the first part. Component event is part of a matter that causes a change in the quantity first. The question component is a question that asks about the effect of the change in the quantity first.

In addition, sometimes when there are variations in the construction of matter, such as event and question components are combined in a syntactic construction, using subordinate clauses or use subjunctif structured "If, so ...?" About that, Gerofsky (1996: 41) found the story problem with the incorporation of components will result in the construction of discourse that is otherwise too long, certainly semantically ambiguous. Therefore, the development discourse about the story must pay attention to three functions of the above components.

2. METHOD

To map the structure type of story problem discourse done by content analysis approach. About the story obtained from the textbook Mathematics for grades 1, 2, and 3 primary schools. Textbooks were studied from three publishers, which are used at most schools. To analyze the data is done by analytic induction, constant comparison, and typological analysis (Cohen, Manion, & Morrison (2007: 467-471).

To create a map of the structure type, previously identified the structure pattern about the story problem in the ninth grade textbook Mathematics 1, 2, and 3. The steps for analyzing is as follows: (1) separating the story problem based on the number of its components, namely three and two components, (2) separate story problems between three and two component based on the presence or absence of incorporation of the components, (3) separate story problems with three components that includes incorporation of components by conjunctions or markers of language used, and (4) classifying matter of the two components is based on the presence or absence merging components. Through such measures, from the identification of a story problem in the nine Mathematics textbooks for grades 1, 2, and 3 was obtained 4 types of structures such as the following.

1. TYPE I: There are three components separately which are constructed by introduction, event, and question component.
2. TYPE II: There are three components, but the introduction and event component is combined by using conjunction words *and*, *while*, or comma.
3. TYPE II : There are three components, but event and question component is combined by using conjunction *if* or comma.
4. TYPE IV : There are two components separately which are constructed by event and question component

3. RESULTS

3.1. Distribution Stoty Problem Discourse in Mathematics Text Books

In nine Mathematics textbooks three publishers there are 329 story problems with details: 73 (22%) in a textbook for class 1, 117 (36%) for class 2, and 141 (42%) for class 3. The distribution of each type can be read in Figure 1.

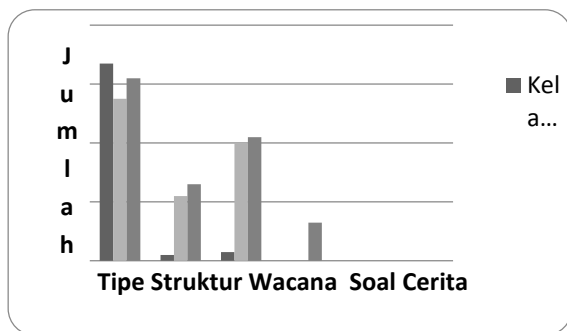


Figure 1. Distribution of the type of story problem discourse in textbooks

The data in Figure 1 indicate that story problem to students grade 1 and 2 only includes the TYPE I, II, and III, while for class 3 includes the TYPE I, II, III, and IV. However, there are differences in the distribution of discourse structure types between classes 1 and 2. For classes 1, most (68 or 93%) story problem discourse of three components presented in separate components (TYPE I) and only a small proportion of type II and III. For class 2, the majority of problems (56 or 48%) is of type I, the others including the TYPE III, and a small portion including TYPE II. As for class 3, the type of discourse structure includes 4 types. Almost the same as the grade 2, about the type II and III enough so that in most problems are merging components. In addition, the type IV showed grade 3 there are problems with the two components. Thus, it can be stated that the higher the grade level, the merger between components matter more and more. In contrast to the lower levels, the less about the story that combined between components. In the following description presented explanations and examples of each type of discourse

3.1.1 Type I: Story problems with three components separately

For example:

- (1) *Diah memiliki 5 buku tulis.* 'Diah has five notebooks'(INTRODUCTION)
Ibu membelikan lagi 2 buku tulis.'Mother bought another 2 notebooks' (EVENT)
Paman memberinya 3 buku tulis.' Uncle gave her three notebooks'.
Berapa buku tulis Diah sekarang? 'How many notebooks Diah now?' (QUESTION)
(Book class 1)

- (2) *Nida memetik 76 rambutan.*' Nida pluck 76 rambutan'(INTRODUCTION)
Clara memetik 20 lebih banyak daripada Nida. 'Clara plucked 20 more than Nida' (EVENT)
Sejumlah 17 rambutan busuk. 'A total of 17 rambutans foul.'
Berapa jumlah rambutan yang bisa dimakan? 'How many rambutan to eat?' (QUESTION)
(Book class 2)
- (3) *Pada hari Minggu, Paman panen jeruk dan salak di kebunnya.*'On Sunday, Uncle harvest oranges and barking in the garden' (INTRODUCTION)
Jeruk yang dipanen sebanyak 17 keranjang.' Oranges harvested as much as 17 baskets'
Salak yang dipanen ada 20 kertonjang. 'Salak harvested there were 20 buckets' (EVENT)
Setiap keranjang memuat 15 kg.' Each basket contains 15 kg.'
Berapa kilogram jeruk dan salak yang dipanen Paman?' How many kilograms of oranges and bark were harvested Uncle?' (QUESTION)
(Book class 3)

The examples above show that story problem with three separate components for grade 1 and 2 has preliminary components shorter than grade 3. In these classes, the introduction components are not loaded explanation of the setting and the characters, while in class 3 loading.

3.1.2. Type II: Story problems with three component whose introduction and event combined

For example:

- (1) *Rara mempunyai 38 permen.* 'Rara has 38 sweets' (INTRODUCTION)
kemudian diminta tuti 12 permen. 'then asked tuti 12 sweets' (EVENT)
Rara diberi lagi 23 permen oleh ibu 'Rara given another 23 sweets by mother'
Berapa banyak permen rara sekarang. 'How much candy rara now' (QUESTION)
(Book class 1)
- (2) *Pak Harja pergi pukul 8 pagi.*'Pak Harja go at 8 am'(INTRODUCTION)
dan pulang pukul 4 sore.'and return at 4 pm.' (EVENT)
Ia istirahat 1 jam.' He rest 1 hour.'
Berapa jam ia bekerja dalam sehari?'How many hours he worked in a day?' (QUESTION)

(Book class 2)

- (3) Mita dan Popi membeli pita di koperasi sekolah. Mita and Popi buy ribbon in koperasi sekolah.
Mita membeli pita sepanjang 3 meter, 'Mita buy 3 meter ribbon' (INTRODUCTION) sedangkan Popi membeli pita 240 cm. 'while Popi buy 240 cm ribbon (EVENT)
Berapa panjang pita Mita dikurangi pita Popi?' 'How centimetres is ribbon Mita and Popi?' (QUESTION)
(Book class 3)

The examples above show that the incorporation of components introduction and events signed by the use of conjunctions *kemudian* 'later', *dan* 'and', as well as the comma. As with type 1, in this type also shows that the introduction of components in a matter.

3.1.3. Type III: Story problems with three component whose event and question combined

For example:

- (1) *Sekarang pukul 11.* 'Now at 11' (INTRODUCTION)
Jika Andi di sekolah selama 4 jam, 'If Andi is in school for 4 hours' (EVENT)
pukul berapakah andi masuk sekolah. 'when time is Andi go to school' (QUESTION)
(Book class 1)
- (2) *Bu Ida membeli 45 buku tulis.* 'Bu Ida buy 45 notebooks.' (INTRODUCTION)
Jika 3 buku tulis diberikan kepada anaknya 'If the 3 notebooks given to his son' (EVENT)
berapa buku tulis Bu Ida sekarang? 'how many notebooks Bu Ida now?' (QUESTION)
(Book class 2)
- (3) *Sekarang pukul 16.30.* 'Now at 16.30' (INTRODUCTION)
Sudah waktunya Pak Bakri pulang dari kantor 'It's time Pak Bakri go home' (INTRODUCTION)
Jika Pak Bakri dikantor selama 8 jam, 'If Pak Bakri is in school for 8 hours' (EVENT)
pukul berapakah dia mulai bekerja. 'how much minute is he works' (QUESTION)
(Book class 3)

Merging the components of events and questions characterized by conjunctions *jika* 'if' resulting in a conditional sentence.

3.1.4. Story problems with two components presented separately

For example: of a story for class 1 and 2 shorter than for grade 3

- (1) *Seorang penjahit telah menjahit 7 lusin pakaian.* 'A tailor has been tailor 7 dozen garments'. (EVENT)
Berapa jumlah pakaian semuanya? "How many clothes everything?" (QUESTION)
(Book class 3)
- (2) *Paman membuat lukisan penari Tor-Tor yang luasnya 49 cm².* 'Uncle makes paintings dancers Tor-Tor which covers 49 cm²' (EVENT)
Berapa dm luas lukisan paman? 'How extensive dm painting uncle?' (QUESTION)
(Book class 3)

The story problem with 2 components only found in textbooks for grade 3. Explicitly this type contains two quantities, namely the quantity of the first part in events and components both on the question. However, the actual component quantity contained questions second and third as well, namely besran unit of measure such as a dozen and dm. The second unit of measure is identical to a certain quantity according to the unit of measure in question. Eg 1 dozen = 12 and 1 dm = 10 cm.

Based on identification of the characteristics of the type of story problem discourse that most exemplified in the above description can be concluded that the matter for grade 1 and 2 on average have shorter structure than a matter for class 3.

4. DISCUSSION

4.1. Discourse of the story problem that the lower grade students performed relatively shorter

Judging from the structure of discourse, a story about problem waking up of three components, namely the introduction, events, and questions. Introduction component serves to clarify the context of the problem so that students will be more a matter of linking content with the real world. To that end, in the introduction to the recommended load narrative elements that accommodate these functions, such as setting and characterizations. However, in reality the introduction of components on story problems for grade 1 and 2 do not contain these elements optimally while for grade 3 majority of the load. Therefore, the structure of discourse to a lower class is relatively shorter due to the introduction of components consists of only one sentence about the story than on textbooks for students in

the upper levels of the average consists of two sentences.

Introduction component consisting of a few sentences makes it possible to deliver more narrative elements. As shown on story problems for students in grade 3. That component contains a richer narrative elements, ie no background or foreground of time and place, other than the actor. With more and the minimum elements contained in the narrative about the story, according to Greer, Verschaffel, and De Corte (2000) made about the context is not clear also enables students to focus their attention only to the component questions. As Zan (2010) found that story problem termed as story problems with the support of a minimum narrative makes the question not give requirement in aspects of narrative logic and it makes the student, especially children, the difficulty of representing matter into mathematical equations.

Based on the above description can be stated that most of the story problems for low-grade students contain minimal narrative element in the preliminary components and some that did not contain the component introduction. In fact, Rowland (2008: 4) states that the components of the initial situation has an important function in connecting the real world with mathematics so that the actors and settings on the matter of the story into the media for that purpose. Of that, Galliher (2004: 2) argues that issues / questions presented in the form of words or in the form of the story gives the impression of a major, how math is used in real life. So its role to connect mathematics to the real world can be realized. Even research Kubala (in Rowland, 2008: 6) found that students majoring in electrical many utilize his experience in solving mathematical word problems characterized as such in practice in the field.

Relevant to this, Sarukkai (2001: 666) states basically the story problem is indeed a translation of non-story problem, but semantically that problem have limited meaning richer while the story problem meaning and it is because of the support of narrative elements in it. In addition, according Gerofsky, the use of elements of narrative (actor, place, and time) relevant to the daily life of the students to make the story problem discourse more realistic and attract students to solve it because it proved they prefer

a matter like that to be done in advance than another matter (1996: 39).

From various studies it was found that one of the causes of low student's ability in solving mathematical problems irrelevance of learning mathematics by mathematical experiences in real life (Evans, 2001: 25 and Gravenmeijer, 2001: 112). Mosvold even find that learning mathematics in the Netherlands is more successful than Japan because of problems in the text book in the Netherlands developed by the school with reference to real life, whereas in Japan only a small part which refers to real life people (2008: 225). Therefore, the experts recommended that the issue of Mathematics easily understood by the students, then the problem submitted must reflect the real world faced by students or relevant to the real context. If the problem is not well known in the context of the student, allowing the problem was difficult to understand. Conversely, if the context of the problem was known even familiar to students allowing such problems easier to understand.

There are some models or procedures used to develop a story problem discourse. The first model developed by Galliher (2004) on elementary students is through the following procedures. The first step, students and teachers make up a story problem based on the experience and the circumstances that surround the student, for example, a student is asked to tell the allowance has bought something or the many games that are owned by the structure of addition, subtraction, and a mix of both for the class beginning, while the structure of summation, subtraction, multiplication, and division for further classes. The second is based on the story of the other students together to solve it. The third step, students and teachers to discuss solving the story problems. Topics of the story problem prepared students in addition based on the experience of students is also based on drawings prepared teachers.

4.2. Merging the discourse generating components of complex sentence structure

To measure the quality of story problems, apart seen from the structure, (Verschaffel, Greer and De Corte, 2000: 3) suggests that the matter judged on three factors. These three factors are as follows: (1) the linguistic level, (2) the levels of mathematical

relationships, and (3) the representation of mathematical symbols. Linguistic levels associated with various linguistic variables, such as number of words or a sentence about the short length. Levels of mathematical logic can be classified in several ways, but the easiest is based on the number of mathematical relations contained in the matter. Problem loading fewer mathematical relationships (eg only a summation) easier to solve than the more relations (eg combination of addition and multiplication). The symbolic representations relating to the use of mathematical symbols, such as m and m^2 , cm and cm^2 . Symbols in the form of derivatives (m^2 and cm^2) is certainly more difficult than non-derivative (m and cm) By Verschaffel, Greer and De Corte (2000), levels of linguistics is listed first because it is based on the results of the research, those factors that most influence on the level the difficulty of translation problems. Thus, the merger between components in the story problem as in textbooks of Mathematics, especially for students in grade 3 could be a source of student difficulties in understanding the questions. This is due to the incorporation of between components matter certainly produce complex sentences, compound sentences in the form of equivalent or terraced. In fact, the use of sentence patterns consisting of clauses could be one source of student difficulties in understanding the language at the story problem (Caldwell and Godin, 1979: 328)

5. CONCLUSION

The conclusion of this study is that the story problem discourse in textbooks of Mathematics for students in grade 1 less than grade 2 and 3. View from the number of its components, with a story problem with two components are not in the textbooks of Mathematics for grades 1 and 2, but there is in the book to grade 3. in addition, the problem with the three components in class 1 and 2 presented shorter than a matter for students in grade 3 for the introduction of components consisting of a

sentence, while the average grade 3 with two sentences. In fact, Introduction components can function to present the context of the story clearer if presented by utilizing more narrative elements, such as setting the time and template besides actor. Therefore, it is advisable elementary school teachers to modify matter contained in the textbook Mathematics making it easier for students to understand the content matter.

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