Mathematics Teaching Research Journal

"Error Analysis of Dyslexic Student's Solution on Fraction Operation Tasks"

1. Submitted to the journal "Mathematics Teaching Research Journal" (11 November 2021)
2. Got first review from two reviewers of Mathematics Teaching-Research Journal (12 Maret 2022)
3. Proof read the manuscript in EIE (19 Maret 2022)
4. Submit revised manuscript based on the reviewers' comments, suggestions, and remarks (21 Maret 2022)
5. Article is accepted and published (https://commons.hostos.cuny.edu/mtrj/archives/volume-14-n-1/) (13 April 2022)

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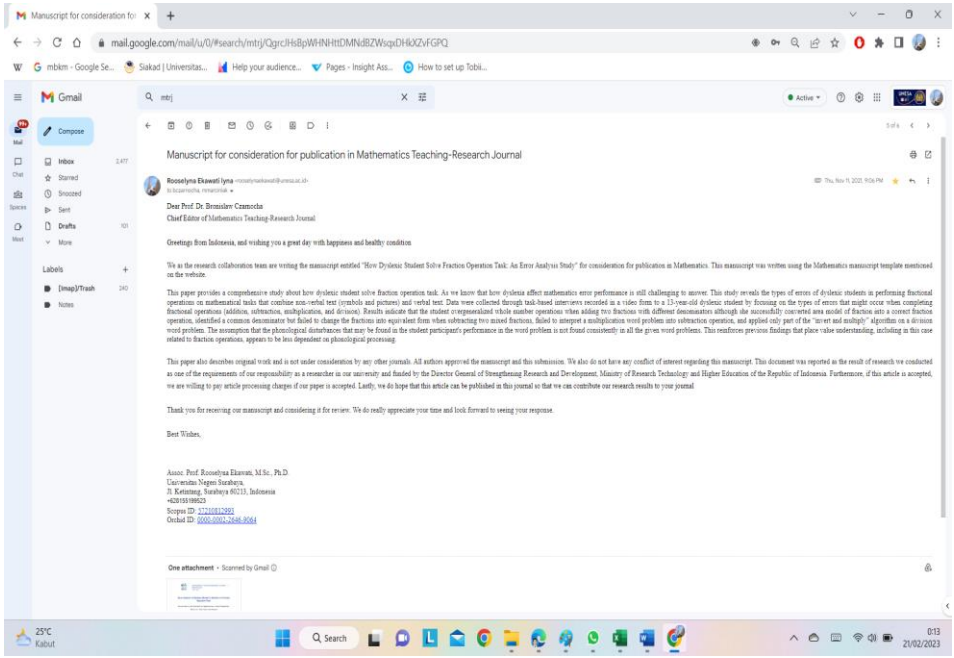

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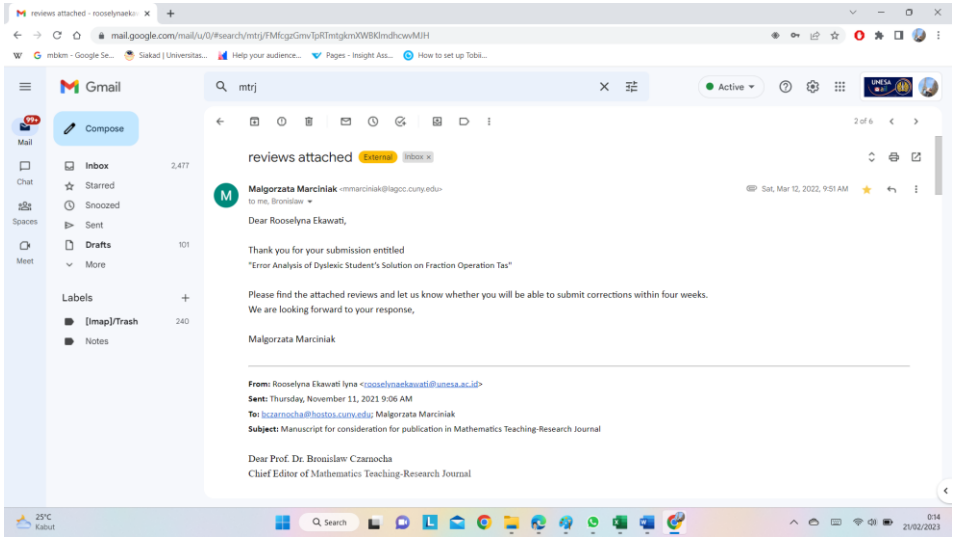

reviews attached - rooselynaek@...

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reviews attached External Inbox ×

2 of 6

Malgorzata Marciniak <mmarciniak@lagcc.cuny.edu>
to me, Bronislaw

Sat, Mar 12, 2022, 9:51 AM

Dear Rooselyna Ekawati,

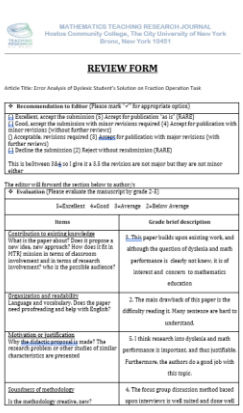
Thank you for your submission entitled
"Error Analysis of Dyslexic Student's Solution on Fraction Operation Tas"

Please find the attached reviews and let us know whether you will be able to submit corrections within four weeks.
We are looking forward to your response,

Malgorzata Marciniak

From: Rooselyna Ekawati Iyna <rooselynaekawati@unesa.ac.id>
Sent: Thursday, November 11, 2021 9:06 AM
To: bczarnocha@hostos.cuny.edu; Malgorzata Marciniak
Subject: Manuscript for consideration for publication in Mathematics Teaching-Research Journal

Dear Prof. Dr. Bronislaw Czarnocha
Chief Editor of Mathematics Teaching-Research Journal



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Hostos Community College, The City University of New York
Bronx, New York 10451

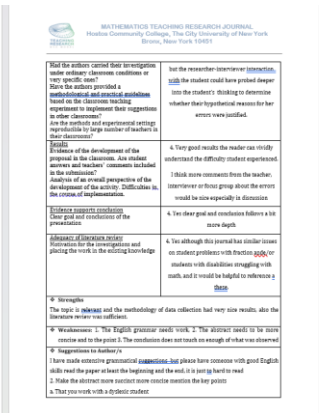
REVIEW FORM

Article Title: Error Analysis of Dyslexic Student's Solution on Fraction Operation Task

❖ Recommendation to Editor (Please mark '✓' for appropriate option)
[ ] Excellent, accept the submission (5) Accept for publication 'as is' (RARE) [ ] Good, accept the submission with minor revisions required (4) Accept for publication with minor revisions (without further review) () Acceptable, revisions required (3) accept for publication with major revisions (with further review) [ ] Decline the submission (2) Reject without resubmission (RARE) This is bellowed like so I give it a 3.5 the revision are not major but they are not minor either

The editor will forward the section below to author/s

❖ Evaluation (Please evaluate the manuscript by grade 2-5) 5=Excellent 4=Good 3=Average 2=Below Average	
Items	Grade brief description
Contribution to existing knowledge What is the paper about? Does it propose a new idea, new approach? How does it fit in MTRJ mission in terms of classroom involvement and in terms of research involvement? who is the possible audience?	4. This paper builds upon existing work, and although the question of dyslexia and math performance is clearly not knew, it is of interest and concern to mathematics education
Expressions and readability Language and vocabulary. Does the paper need proofreading and help with English?	2. The main drawback of this paper is the difficulty reading it. Many sentence are hard to understand.
Motivation or justification Why the dyslectic proposal is made? The research problem or other studies of similar characteristics are presented	5. I think research into dyslexia and math performance is important, and thus justifiable. Furthermore, the authors do a good job with this topic.
Soundness of methodology Is the methodology creative, new?	4. The focus group discussion method based upon interviews is well suited and done well



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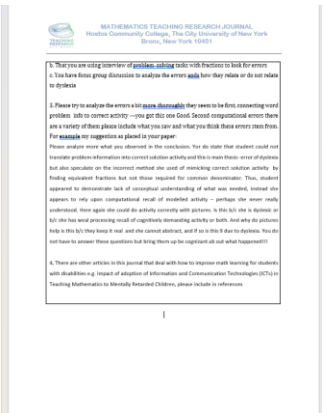
Find the authors carried their investigation under ordinary classroom conditions or very specific ones? Have the authors provided a methodological and practical guidelines based on the classroom teaching experiment to implement their suggestions in other classrooms? Are the methods and experimental settings reproducible by large number of teachers in their classrooms?	but the researcher-interviewer interaction with the student could have probed deeper into the student's thinking to determine whether their hypothetical reasons for her errors were justified.
Results Evidence of the development of the proposal in the classroom. Are student answers and teachers' comments included in the submission? Analysis of an overall perspective of the development of the activity. Difficulties in the course of implementation.	4. Very good results the reader can vividly understand the difficulty student experienced. I think more comments from the teacher, interviewer or focus group about the errors would be nice especially in discussion
Evidence supports conclusion Clear goal and conclusions of the presentation	4. Yes clear goal and conclusion follows a bit more depth
Adequacy of literature review Motivation for the investigations and placing the work in the existing knowledge	4. Yes although this journal has similar issues on student problems with fraction add/or students with disabilities struggling with math, and it would be helpful to reference a these.
❖ Strengths The topic is relevant and the methodology of data collection had very nice results. also the literature review was sufficient.	
❖ Weaknesses 1. The English grammar needs work. 2. The abstract needs to be more concise and to the point 3. The conclusion does not touch on enough of what was observed	
❖ Suggestions to Author/s I have made extensive grammatical suggestions- but please have someone with good English skills read the paper at least the beginning and the end. it is just to hard to read 2. Make the abstract more succinct more concise mention the key points a. That you work with a dyslexic student	



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b. That you are using interview of problem solving tasks with fractions to look for errors
c. You have focus group discussion to analyze the errors and/o how they relate or do not relate to dyslexia

3. Please try to analyze the errors a bit more thoroughly they seem to be first, connecting word problem info to correct activity —you got this one Good. Second computational errors there are a variety of them please include what you saw and what you think these errors stem from. For example my suggestion as placed in your paper

Please analyze more what you observed in the conclusion. For do state that student could not translate problem information into correct solution activity and this is main thesis- error of dyslexia but also speculate on the incorrect method she used of mimicking correct solution activity by finding equivalent fractions but not those required for common denominator. Thus, student appeared to demonstrate lack of conceptual understanding of what was needed, instead she appears to rely upon computational recall of modelled activity – perhaps she never really understood. Here again she could do activity correctly with pictures. Is this b/c she is dyslexic or b/c she has weak processing recall of cognitively demanding activity or both. And why do pictures help is this b/c they keep it real and she cannot abstract, and if so is this 9 due to dyslexia. You do not have to answer these questions but bring them up be cognizant ab out what happened!!!

4. There are other articles in this journal that deal with how to improve math learning for students with disabilities e.g. Impact of adoption of Information and Communication Technologies (ICTs) in Teaching Mathematics to Mentally Retarded Children, please include in references

Reviewer 1:

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Error Analysis of Dyslexic Student's Solution on Fraction Operation Task

Rooselyna Ekawati[1], Elly Matul Imah[1], Siti Maghfirotun Amin[2], Ahmad Wachidul Kohar[1], [3]Khoirun Nisa', Rully Charitas Indra Prahmana[4]

[1]Departement of Mathematics of Universitas Negeri Surabaya, Surabaya, Indonesia, [2]Elementary Education Study Program of Universitas Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia, [3]Postgraduate School of Universitas Negeri Surabaya, Surabaya, Indonesia, [4]Universitas Ahmad Dahlan, Yogyakarta, Indonesia

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***Abstract**: How dyslexia affect mathematics error performance is still challenging to answer. This study reveals the types of errors of dyslexic students in performing fractional operations on mathematical tasks that combine non-verbal text (symbols and pictures) and verbal text. Data were collected through task-based interviews recorded in a video form to a 13-year-old dyslexic student by focusing on the types of errors that might occur when completing fractional operations (addition, subtraction, multiplication, and division). Results indicate that the student overgeneralized whole number operations when adding two fractions with different denominators although she successfully converted area model of fraction into a correct fraction operation, identified a common denominator but failed to change the fractions into equivalent form when subtracting two mixed fractions, failed to interpret a multiplication word problem into subtraction operation, and applied only part of the "invert and multiply" algorithm on a division word problem. The assumption that the phonological disturbances that may be found in the student participant's performance in the word problem is not found consistently in all the given word problems. This reinforces previous findings that place value understanding, including in this case related to fraction operations, appears to be less dependent on phonological processing.*

Commented [WB1]: How dyslexia affects… or The question of How dyslexia effect mathematics error performance is still a challenge to answer.

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Data…task-based interviews of a 13 year-old dyslexic student, recorded by video, and focused on the type of errors…

INTRODUCTION

There is emerging evidence that dyslexia is linked to mathematics difficulties. Although dyslexia is often thought of as a disorder of reading and writing, studies have reported that dyslexic children and adults are slower and less accurate at remembering arithmetic facts than non-dyslexic children

and adults (Simmons & Singleton, 2006). One explanation of these findings is that dyslexic children's phonological processing deficits have an adverse effect on the development of arithmetic fact memory (Simmons & Singleton, 2008). This is in line with the finding of Simmons and Singleton (2008) reporting that the main difficulty of dyslexic children is the ability to remember number facts so that they are slow in calculating or verifying sums of numbers. In the case, the memory footprint for an arithmetic question may deteriorate before the answer is calculated. In addition, slow computations can exacerbate this problem, as it increases the time it takes to store the problem in working memory while the answer is computed. In particular, Cornoldi et al (2021) in their recent study concluded that a dyslexic not only has difficulty in reading and writing in terms of alphabetic material, but also numerical material (symbolic).

Nevertheless, some studies indicate insignificant correlation between students' mathematical performance and the symptoms of dyslexia. For example, Simmons' (2002) study showed that there was a statistically significant relationship between non-verbal reasoning ability and place value understanding, but there was no significant relationship between phonological circle function and place value understanding in children aged 7 to 11 years. This finding motivated some researchers to investigate further whether dyslexics' weaknesses in processing numbers in mathematical tasks were mainly related to language processing weaknesses (e.g, problems with number facts and exact calculations) or weaknesses in performing mathematical processes, such as comparing a quantity and estimating the results of calculations. This simple question remains a source of controversy. The study of Simmons and Singleton (2009) found that dyslexic children have slower and less accurate memory of numerical facts than non-dyslexic children, but have an undisturbed understanding of place value. In addition, Simmon and Singleton (2008) concluded that the existence of the dyslexic group's arithmetical weakness could not be attributed to their dyslexic difficulties or because of their weaker intellectual abilities. More specifically, they added that the aspects of mathematics that are less dependent on verbal codes (eg estimation, , subitising) are not impaired. This is reinforced by the findings of Träff and Passolunghi (2015) reporting that dyslexic students performed worse than students in the control group on number fact-taking, multi-step arithmetic problem solving, and multi-digit computation, whereas they scored on tasks involving arithmetical approximations as well as conceptual understanding such as place value and principles in count operations did not differ from those in the control group.

Research on investigating dyslexic students' number processing skill, however, is still less underreported. Place value understanding become main factor affecting students' success on giving solution on number processing task. In relation to dyslexic student's performance on place value, there is evidence that dyslexic students are less accurate and slower in multiplying two single-digit numbers in non-verbal tasks (Boets & De Smedt, 2010). Another finding with non-verbal task is reported by Koerte et al (2016) reporting that there is no any significant difference between group of dyslexic and non-dyslexic regarding their performance on nonverbal number line tasks, which is still linked to place value understanding.

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Commented [WB5]: , subitising British English? Do you mean subitizing

Commented [WB6]: Too many adjectives itg does not make sense I think you mean to say: however, is underreported ?????

While researchers have focused on the number processing skill on whole or natural numbers (e.g. Träff, Desoete, & Passolunghi, 2017; Teixeira & Moura, 2019), research on how dyslexic students performed place value understanding on fraction-related task is not reported yet, whereas place value is important to be used as a basis for understanding in fraction operations. Place value understanding is important since it can be used to figure out that the numerator and denominator of a fraction were not made up of different groups of place value. Therefore, research on number processing skill which specifically discuss dyslexic student's performance on fraction operation needs to be further studied.

In performing solution on any fraction-related task, a solver, including a dyslexic student, needs to be aware of the existence of errors when providing the solution. According to Siyepu (2013), an error is the incorrect answer due to planning, where this error is done systematically because it is applied regularly in the same situation as a symptom of the conceptual structure that causes the error. It may be found from students' previous learning, either in mathematics class or from their interactions with the social and physical world (Smith et al., 1993). More specifically, errors in fraction operation have been identified by Brown and Quinn (2006) into six main categories, namely algorithmic applications, applications of basic concept on fraction operation in word problem, elementary algebraic concept, specific arithmetic skills for algebraic understanding, comprehension of the structure of rational number, and computational fluency. The first two categories become crucial aspects that every learner, especially those ~~who learn fraction~~ in primary school, need to be proficient as they are frequently found in the students' solution strategies. Regarding algorithmic application as the basic skill on solving fraction operation task, Ashlock (2006) also identified four types of errors, namely incorrectly writing a fraction representing a shaded area of a figure, failing to simplify fraction into a simplest form, incorrectly dealing with numerator and denominator of a fraction when adding or subtraction two fractions. Hwang and Riccomini (2021) also identified the most common errors in students' solutions to the fraction operation task, namely failing to decompose mixed numbers into integers and fractional parts or converting mixed numbers into ordinary fractions when performing addition operations.

This research tried to unpack dyslexic student errors on fraction through fraction operation task covering both verbal and non-verbal information. Thus, the aims of this study is to analyze the errors of dyslexic student in performing solution strategies on fraction operation task covering addition, subtraction, multiplication, or division.

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...important as a basis for understanding...

Commented [WB8]: ,and organized into six main...

Commented [WB9]:
This is a good review of common errors for fractiosn

RESEARCH METHOD

Research Design

This research follows a case study research design, namely by investigating contemporary phenomena in depth and in the context of the real world (Yin, 2014, p. 237). The purpose of the case study design is to answer the "how" and "why" questions (Yin, 2014, p. 2). In this study, we

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The methodology follows a case study research design / or
This research follows a case study design

try to uncover how a dyslexic student solves problems related to fraction operations by focusing on investigating the types of errors that may occur and investigating why they occur in a Group Discussion Forum activity with parents of participating students, mathematics education experts, outside education experts. ordinary students, as well as the teacher and teacher of the participating students. In addition, the researcher has little or no control over the events that may occur during the interview (Yin, 2014).

The student participant, i.e. the dyslexic student, was recruited by means of a letter of consent that the children took home to the parents from school. At the time of interviewing, she was 12-year old and she had normal or corrected-to-normal visual acuity, and no hearing loss.

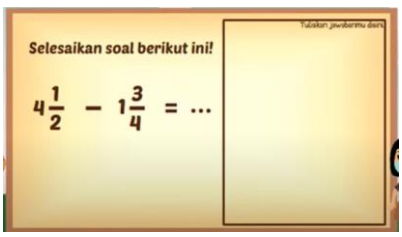
A task-based interview was prepared by writing a semi-structured interview guideline and a set of fraction operation task. The set of fraction operation task was designed and developed by focusing on the combination of text types, i.e. verbal & non-verbal for every task. A group discussion consisting of ten teachers, the researchers, and an expert in mathematics education were involved in a forum group discussion to review the initial draft of task. The fraction operation task was designed and developed by focusing its feature with four basic fraction operation: addition, subtraction, multiplication, and division. Some of them were in the non-verbal text (symbolic and figural) or verbal text only, while others combine non-verbal and verbal text.

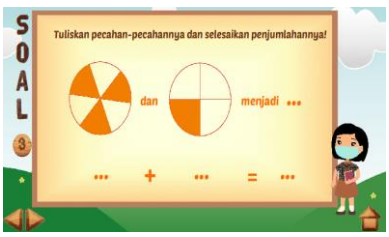
Table 1. Feature of task

Fraction operation	**Types of text**
Addition	Verbal and non-verbal (figural & symbolic)
Subtraction	Non-verbal (symbolic)
Multiplication	Verbal
Division	Verbal and non-verbal (figural)

Table 1 indicates the distribution of task regarding types of text resulted from the revision of the initial draft after the review, while figure 1 indicates an example of the task of fraction addition and subtraction. The addition task asks student to represent two fraction models as two different fraction then add those two fractions, while the subtraction task asks the student to subtract two mixed number with different denominators.

Commented [WB11]: -fractions (plural)





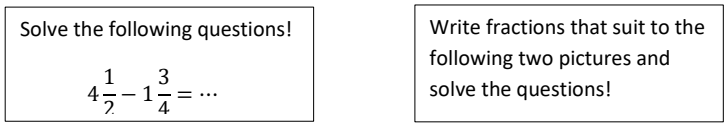


Figure 1. Example of Addition and Subtraction Task

The interview activity was conducted through an online platform synchronously and recorded along the interview as long as one hour. During the interview, the student participant explained how to answer the given question by the guidance of the interviewer. Through the interview, the interviewer got the student participant's thinking process in fraction operation task.

Commented [WB12]: Bad sentence try: ,and was recorded for up to one hour,

Data Analysis

Data analysis was done through Focus Group Discussion (FGD) of several experts in East Java, Indonesia. In general, our FGD aims to explore the level of consensus of FGD participants on the interpretation of the work carried out by students of research subjects. Technically, the authors present the recorded video of interviewing the student participant and some of student participant's responses on the task. On the other hand, this FGD was also used to collect opinions, ideas, and beliefs of the FGD participants on topics related to how normal students compare with dyslexic students in terms of solving fraction operation problems, how the symptoms of dyslexia on the mathematical ability of dyslexic children, and issues related to relevant to the research discussion.

RESULTS AND DISCUSSION

Errors in Addition and Subtraction

The feature of task for addition of two fractions is verbal and non-verbal (figural & symbolic). A word problem, "The students in class 5A come from various ethnic groups, $\frac{4}{5}$ of Javanese students, $\frac{3}{16}$ of Balinese students, and the rest are from Sundanese. How many students are from the Sundanese?" does not lead the participant to do subtraction, for example, by subtracting 1 as whole by the sum of $\frac{4}{5}$ and $\frac{3}{16}$. Instead, she added the two numbers (symbolic code) emerging in the written

Commented [WB13]: Not sue but think this sentence should read : , and the rest are from Sundan. Or perhaps: ,and the rest are Sundanese,

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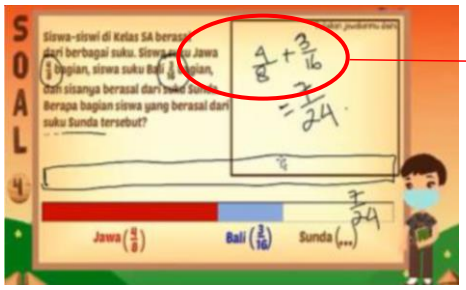
text without any further consideration of the contextual meaning of the word problem. When the interviewer asked her, “Do you use this bar to guide you understand the problem?”, she said,” Yes. I did”. However, she could not explain how she used the bar as part of her solution by concerning on the size of bar representing $\frac{4}{5}$ and $\frac{3}{16}$. Therefore, the students solve the problem without understanding the problem as a whole.



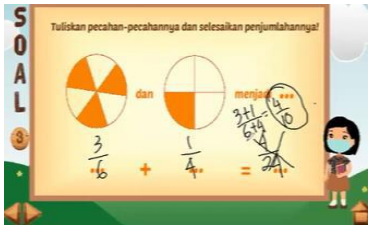
(Overgeneralized whole number operations)

Students in grade 5A came from various ethnic. $\frac{4}{8}$ of them are Javanese, $\frac{3}{16}$ of them are Balinese, and the rest are Sundanese. How many students are Sundanese?

Figure 2. Participant’s solution on fraction addition task

Commented [WB15]: If the student had overgeneralized addition of whole numbers she would have gotten 7/14 so how did she get the 24 denominator?

This finding is consistent with her performance on another addition/subtraction task, namely adding two fractions by writing the fraction of two area models first as indicated in Figure 3. Again, the student participant solves the problem without understanding the problem as a whole. She immediately added up the numerator and denominator without changing to the same denominator first.



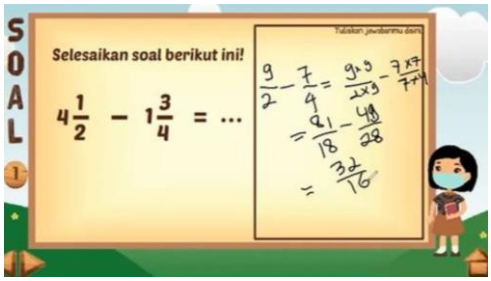
Write fractions that suit to the following two pictures and solve the questions!

Figure 3. Participant’s solution on determining and adding fraction

Instead, as with most children, the participant overgeneralized operations on fractions, such that the numerator was operated alone with the numerator, and the denominator was also operated independently with the denominator. Thus, there is a hypothesis that she avoid dealing with written text as the phonological structure that makes her difficult to understand.

From a cognitive perspective, it is possible to process fractions either componential — as two separate integers (3 and 16) or holistically as one (rational) number with one overall magnitude (i.e., the numeric value 3/16). This distinction between component and holistic processing is useful for understanding why people have difficulty solving fractional problems: many of the errors students make in fractional problems appear to be due to their dependence on component processing in problems that require holistic processing.

The given question to the dyslexic student participant is not only word problem, but also a direct question that asking student participant to solve fraction operation such as "solve the following problem $4\frac{1}{2} - 1\frac{3}{4}$". In this problem, student participant was asked to determine the result of subtracting two mixed fractions. To solve the problem, the student participant concerts mixed fractions into common fraction correctly, she got $\frac{9}{2}$ and $\frac{7}{4}$. In the subtraction operation, student realizes that the denominators are different so it takes another step before subtracting. But when student tried to convert to the same denominator, student failed to convert it into an equivalent form. She multiplied the first fraction by $\frac{9}{9}$ and the second fractions by $\frac{7}{4}$, so the operation become $\frac{81}{18} - \frac{49}{28}$. Then, she subtracted the numerator and denominator separately without concerning that the denominator is still different. By subtracting the numerator, the student participant got 32. But she incorrectly subtracting the denominator that shown in the Figure 4. She subtracted the smaller number from the larger number but forget to put negative sign in the result and got the wrong answer.



Solve the following problem!

$$4\frac{1}{2} - 1\frac{3}{4} = \cdots$$

Figure 4. Participant's solution on mixed fractions operation

Errors in Multiplication and Division

Commented [WB16]: This is such a common error in all students of all ages you need to explain why the hypothesis that there is a phonological aspect to this common error. Why is her difficulty not simply due to the structural complexity of fractions. ?

Commented [WB17]: The sentence structure itself is not so good try: Thus, we consider the hypothesis that she avoids dealing with the written text due to its complicated structure, and in particular we consider whether there is a phonological component to her avoidance,

Commented [WB18]: Awful two sentences…Try something like: The participant student was given word problems, as well as direct-computations such as, "solve the …

Commented [WB19]: You mean converts?

Commented [WB20]: Yes this is very good and agrees with earlier error, the student is not overgeneralizing addition she is applying her strategy and it mimics the correct one she has observed but she is not applying it correctly due probably to lack of knowledge about need for common denominator.

Commented [WB21]: But she then incorrectly subtracts the denominator as shown in Figure 4

Commented [WB22]: Please comment on how she got the 16 den. Not just overgeneralization What is her thinking when she multiplies to convert to equivalent fraction? Probably she is mimicking external activity modeled by teacher but does not have internal reasoning to direct her activity but you should comment -hypothesize what you think

The task of multiplication and division of fraction were given in a word problem. “A mom has $2\frac{1}{2}$ sacks of flour. If each sack contains of $\frac{2}{5}$ quintals of flour. How many quintals of flour does mom have in total?”. She admits that she does not really understand the whole problem, this is indicated in the Figure 4. When the interviewer asked her, “What do you think about this problem?”, she said “It is difficult”. By the interviewer’s guidance, the student participant got $2\frac{1}{2} - \frac{2}{5}$ as the solution of the problem.

Mother has 2 ½ sack of fluor. If every sack contain 2/5 kuintal of fluor, how much kuintal of fluor that mother has?

Figure 5. Participant’s solution on multiplication of fractions

Figure 5 shows that this problem is supposed to be a multiplication operation problem, but the student participant fails to understand that the solution is to use multiplication. The student participant solves this problem using the subtraction operation. In this subtraction operation, the student adds the denominator and numerator without converting it to a form with the same denominator. In addition, the student performs a subtraction operation by subtracting a large number by a small number regardless of the location of the number. She also got the wrong answer for 2 – 5, she writes 2 as the solution.

On the other hand, the student participant succeeded understanding the meaning of a word problem, “Abi has $1\frac{1}{5}$ liter of milk. The milk will be poured in some glasses. Each glass contains of $\frac{1}{5}$ liter of milk. How many glasses that Abi need?”. This problem is a division operation problem and the student participant was able to take the first step as indicated in the Figure 6.

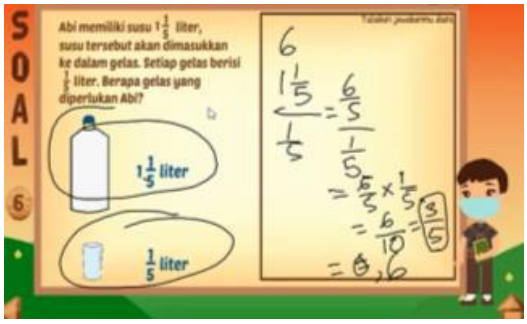
Commented [WB23]: Task …was or tasks …were (plural singular agreement)

Commented [WB24]: Ok but this is incorrect so NOT GUIDANCE perhaps tgry After the interviewer’s question/comments the student writes … or incorrectly decides it is a subtraction problem.

Commented [WB25]: Requires the use of multiplication

Commented [WB26]: Instead, the student…incorrectly solves this problem…

Commented [WB27]: It is clear that the student commits multi8ploe errors, she does not understand what operation is required, and she has not internalized the activity she incorrectly applies.



Abi has $1\frac{1}{5}$ liter of milk. The milk will be poured in some glasses. Each glass contains of $\frac{1}{5}$ liter of milk. How many glasses that Abi need?

Figure 6. Participant's solution on division of fractions

As the first step is right, the interviewer asked, "which part of the question that helped you solving the problem?" and the student participant answered "the picture, because there is a big bottle and small glass". Then the interviewer asked, "what about if there is no picture? Will you understand the problem easily?", she said "if there is no picture, I will try to use my imagination". Which means that dyslexic students often use picture to understanding something and has difficulty to understand a word problem.

Commented [WB28]: Excellent observation about dyslexia and math performance they need it to be real and pictures help. They do not seem to handle abstraction well. Course this may be only this student dyslexia is a spectrum very vide

Based on the division of fractions' rules that we need to convert it into multiplication, the student participant succeeded to convert it into multiplication. However, student participant forgot to invert the second fraction. It should be $\frac{5}{1}$ but she writes $\frac{1}{5}$. In the multiplication operation, the numerator was multiplied correctly, but the student treated 5×5 as $5 + 5$ in the denominator. This finding is quite interesting since most errors within a multiplication problem found when a solver should keep the denominator the same before multiplying corresponding numerators and denominators. According to Yin (2014), this finding is related to students may believe that if denominators are equal, they should keep the denominator in the solution; otherwise, the denominators should be combined using the operation provided. There is a student's belief that if the size of the denominator of a fraction is the same, then the denominator must still appear in the final answer, regardless of the fraction operation, including multiplication.

Based on student participant's solution on several fraction operation tasks, it is shown her inconsistent behavior in solving fraction operation which leads to errors in performing fraction operation. While many researchers argue that such errors occur because of insufficient understanding of fraction concepts (e.g. Newton, 2014), the possible reason that cause student participant to think inconsistently in solving fraction operation problem might because of the symptoms of dyslexia that makes student participant difficulty understand a word problem. This is linear with student participant's statement that she always look for number or picture that helped her in understanding a word problem and if there are no picture, she is trying to imagine the problem visually. On the other hand, after failed understanding

the problem, the student participant often failed doing the fraction operation. This is not caused by her inability doing the operation, this is in line with Singleton (2008) that stated dyslexic student are slow in calculating because they difficulty remember number facts.

With regard to phonological processing during her mathematical computation skill, the finding that the student participant failed to convert all the word problem into a precise mathematical procedure indicate that she might found difficulties in phonological processing when interpreting the written text. It can be explained that there is a relationship between reading skills and general computational skills (Newton, 2014; Yang et al. 2021), which explains the possibility that reading and mastery of mathematics, including number processing skill, may influence to some extent growth in phonological processing (Hecht, 2001).

The results of this study also call for other unanswered questions to be further studied regarding the cognitive processed performed by a dyscalculic student to solve fraction operation task. It is interesting when the student participant tried to focus on the symbolic information, which is any number found within the whole text, instead of the written text information. It challenges to understand whether her preference is due to the symptoms of dyslexia or her weak number processing skills. Thus, her actual cognitive processes need to be investigated through another method such as eye-tracking. In relation to fraction, for example, eye-tracking could examine whether an individual may solve a fraction comparison task using componential strategies, which rely on the fraction numerators or denominators, or a combination of both, or holistic strategies which concerned on the magnitude of fraction. (Obersteiner & Tumpek, 2016). In normal people, eye-tracking has also been reported as a tool to measure the amount of fixation concentrated on the denominator or numerator of a fraction when comparing fractions or even adding fractions (Huber et al 2014). Thus, processing the denominator of a fraction tends to require more cognitive effort than processing the numerator of a fraction. How the implications of this finding with the alleged performance of a dyslexic when comparing or adding two fractions needs to be investigated further.

CONCLUSIONS

The present study showing dyslexic students' difficulty in solving fraction operation task. The task given consist of addition, subtraction, multiplication, and division problem which is presented in a word problem or calculation task. Based on the student participant's solution, we can see that dyslexic students often think inconsistently in doing fraction operation and difficulty understand a word problem. Dyslexic students failed to determine the operation that suit to the problem. But if we guide them and explain the meaning of the word problem, they easily understand. They need picture and number to help them understand the problem.

Commented [WB29]: -,and experience difficulty understanding a word problem.

The challenge in this study can be found in exploring dyslexic student's thinking process and their error by direct interview in the pandemic situation. We need to understand the

correct moment of dyslexic students in working and explaining their solution. The potential future research that is done with regard this study finding is by incorporating the eye-tracker tools and its developed software to investigate the dyslexic students cognitive process accurately.

Commented [WB30]: Please analyze more what you observed in the conclusion. Yor do state that student could not translate problem information into correct solution activity and this is main thesis -error of dyslexia or hypothesis but also speculate on the very common method she used of mimicking correct solution activity by finding equivalent fractions but not those required for common denominator.. Thus, student demonstrated lack of conceptual understanding of what was needed, appear to rely upon computational recall of modelled activity was not ever really understood. Here again she could do activity correcly with pictures. Is this b/c she is dyslexic or b/c she has weal processing recall of cognitively demanding activity or both. And why do pictures help is this b/c they keep it real and she cannot abstract, and if so is this 9 due to dyslexia. You do not have to answer these questions but bring them up be cognizant ab out what happened!!!

ACKNOWLEDGEMENT

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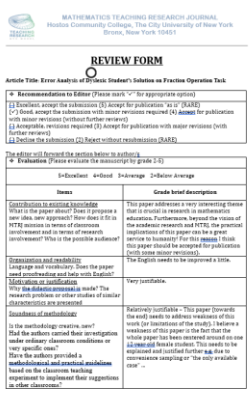

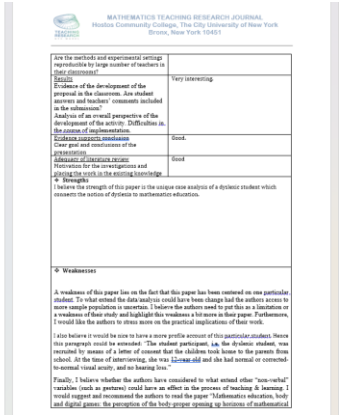

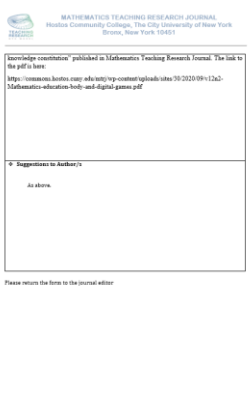

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Article Title: **Error Analysis of Dyslexic Student's Solution on Fraction Operation Task**

❖ **Recommendation to Editor** (Please mark "✓" for appropriate option)
( ) Excellent, accept the submission (5) Accept for publication "as is" (RARE) (✓) Good, accept the submission with minor revisions required (4) Accept for publication with minor revisions (without further reviews) ( ) Acceptable, revisions required (3) Accept for publication with major revisions (with further reviews) ( ) Decline the submission (2) Reject without resubmission (RARE)

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❖ **Evaluation** (Please evaluate the manuscript by grade 2-5)

5=Excellent 4=Good 3=Average 2=Below Average	
Items	**Grade brief description**
Contribution to existing knowledge What is the paper about? Does it propose a new idea, new approach? How does it fit in MTRJ mission in terms of classroom involvement and in terms of research involvement? Who is the possible audience?	This paper addresses a very interesting theme that is crucial in research in mathematics education. Furthermore, beyond the vision of the academic research and MTRJ, the practical implications of this paper can be a great service to humanity! For this reason I think this paper should be accepted for publication (with some minor revisions).
Organization and readability Language and vocabulary. Does the paper need proofreading and help with English?	The English needs to be improved a little.
Motivation or justification Why the didactic proposal is made? The research problem or other studies of similar characteristics are presented	Very justifiable.
Soundness of methodology Is the methodology creative, new? Had the authors carried their investigation under ordinary classroom conditions or very specific ones? Have the authors provided a methodological and practical guidelines based on the classroom teaching experiment to implement their suggestions in other classrooms? Are the methods and experimental settings reproducible by large number of teachers in their classrooms?	Relatively justifiable – This paper (towards the end) needs to address weakness of this work (or limitations of the study). I believe a weakness of this paper is the fact that the whole paper has been centered around on one 12 year old female student. This needs to be explained and justified further e.g. due to convenience sampling or "the only available case" …
Results Evidence of the development of the proposal in the classroom. Are student answers and teachers' comments included in the submission? Analysis of an overall perspective of the development of the activity. Difficulties in the course of implementation.	Very interesting.
Evidence supports conclusion Clear goal and conclusions of the presentation	Good.
Adequacy of literature review Motivation for the investigations and placing the work in the existing knowledge	Good

❖ **Strengths**

I believe the strength of this paper is the unique case analysis of a dyslexic student which connects the notion of dyslexia to mathematics education.

❖ **Weaknesses**

A weakness of this paper lies on the fact that this paper has been centered on one particular student. To what extend the data/analysis could have been change had the authors access to more sample population is uncertain. I believe the authors need to put this as a limitation or a weakness of their study and highlight this weakness a bit more in their paper. Furthermore, I would like the authors to stress more on the practical implications of their work.

I also believe it would be nice to have a more profile account of this particular student. Hence this paragraph could be extended: "The student participant, i.e. the dyslexic student, was recruited by means of a letter of consent that the children took home to the parents from school. At the time of interviewing, she was 12-year old and she had normal or corrected-to-normal visual acuity, and no hearing loss."

Finally, I believe whether the authors have considered to what extend other "non-verbal" variables (such as gestures) could have an effect in the process of teaching & learning. I would suggest and recommend the authors to read the paper "Mathematics education, body and digital games: the perception of the body-proper opening up horizons of mathematical knowledge constitution" published in Mathematics Teaching Research Journal. The link to the pdf is here:

https://commons.hostos.cuny.edu/mtrj/wp-content/uploads/sites/30/2020/09/v12n2-Mathematics-education-body-and-digital-games.pdf

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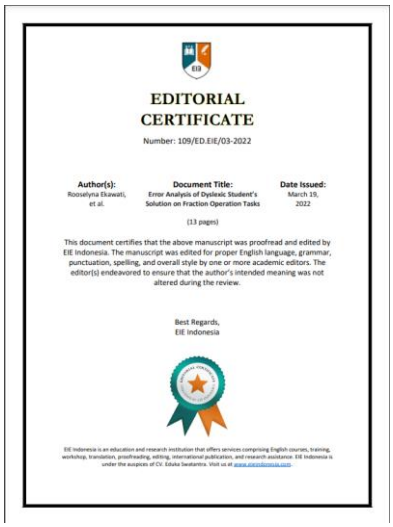

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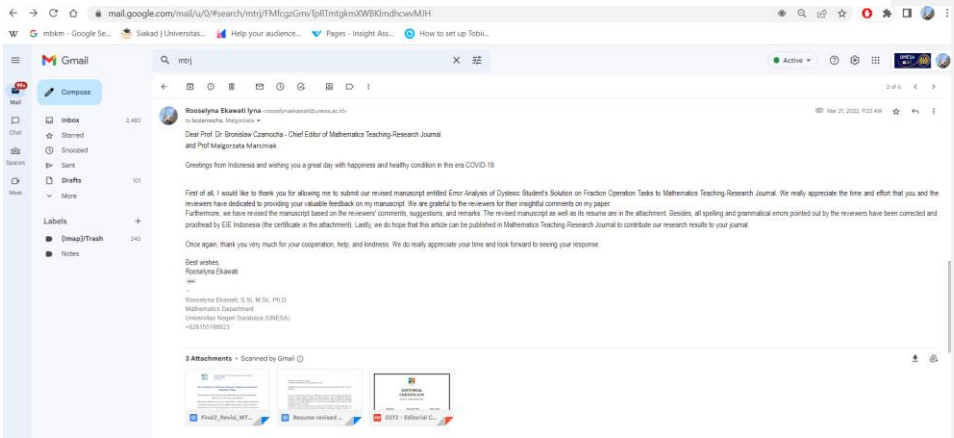

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