**Recapitulation the contents of the revised article**

Manuscript title: An Investigation of Students’ Algebraic Proficiency from a Structure Sense Perspective

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| **No** | **Reviewer** | **Content** | **Page** | **Problem** | **Revised** | **Page** |
| 1. | A | Introduction | 1-2 | As the audience of this journal is international scholars, the authors should consider the preliminary background of this paper. Instead of directly telling the algebra issue in Indonesia, the author should start with the idea of how algebra issues have been emerging in international perspectives. More particularly, the authors should better start with the issue of structure sense in algebraic proficiency. Thus, paragraph 2 could be better as the introduction in this paper.  | We have revised the paragraph 1 and paragraph 2 as suggested by the reviewer A and reviewer B. Also, we have add references for a reason of investigating algebraic proficiency in Indonesia for secondary school students as the following:*Algebra as one of the branches of mathematics is considered to be an important domain for secondary school students over the world for either advanced study or professional work (Bednarz et al., 1996; Carraher et al., 2006; Katz, 2007; Kop et al., 2020). Proficiency in algebra domain is therefore one of the preconditions for school students to pursue their future careers. Algebraic proficiency, which can be described as a matter of proficiency with symbolic representations, in general includes procedural fluency and conceptual understanding (MacGregor & Price, 1999; McCallum, 2007; Stiphout et al., 2013). In previous studies, these two aspects of algebraic proficiency are often assessed through the lens of symbol sense and structure sense (Bokhove & Drijvers, 2010; Bokhove & Drijvers, 2012; Novotna & Hoch, 2008; Stiphout et al., 2013). The results of these studies showed that the lens of structure sense is fruitful to explain lack of student conceptual understanding and procedural skills in algebra.* *The lack of student algebraic proficiency occurred over the world, including in Indonesia. Results of international survey studies, such as Trends in International Mathematics and Science Study (TIMSS) in 2011, showed that Indonesian students have a low score in algebra, i.e., the students were in 38th position out of 42 countries (Mullis et al., 2012). Regarding this low score in algebra, previous studies have investigated student difficulties in school algebra, in which the results revealed that Indonesian students lack of both algebraic procedural skills and conceptual understanding (Apsari et al., 2020a; Apsari et al., 2020b; Jupri et al., 2014a; Jupri et al., 2015; Sugiarti & Retnawati, 2019; Wahyuni et al., 2019). These aspects of algebraic proficiency for Indonesian students therefore need to be further explored. In Indonesia, however, research for investigating students’ algebraic proficiency in terms of structure sense is still limited and is focused on initial algebra learning (e.g., Jupri et al., 2014b), and on abstract algebra for university students (e.g., Junarti et al., 2019). In other words, an investigation of student algebraic proficiency for students who have learned a more advanced study of school algebra in Indonesia, to certain extent, is still unexplored. Therefore, this current study aims to investigate secondary school students’ algebraic proficiency from a structure sense perspective.*   | 1-2 |
| 2. | D | Introduction | 1-2 | While the article offers a comprehensive discussion of students’ algebraic proficiency investigation in terms of structure sense, it does not make a cohesive argument as to why a structure sense employing student algebraic proficiency is viable for grade XI students in Indonesia.The article has an interesting premise and the education arguments are persuasive, however, the article needs significant revisions before it is suitable for publication. The methods were unclear and there needed to be a great deal more synthesis throughout the literature review. I suggest restructuring the article to first discuss student algebraic proficiency then move into how structure sense has been employed and investigated in various symbolic expressions before then discussing the important thing that would be mastered by secondary school students. This may help build your argument more strongly. |
| 3. | A | Introduction | 2 | To convince the reader of this claim, it is better for the author to add some more evidence that there are very few studies on structure sense in relation to algebraic proficiency in Indonesia. One example, which is Jupri et al, is not sufficient.  Although, for example, there are still a few, to what extent has Jupri et al. What is the contribution of this research to the development of studies on structure sense in algebraic proficiency in Indonesia? | We have add some more evidence (a reference) that there are very few studies on structure sense in relation to algebraic proficiency in Indonesia, as can be seen in part of paragraph 2, as the following:*… In Indonesia, however, research for investigating students’ algebraic proficiency in terms of structure sense is still limited and is focused on initial algebra learning (e.g., Jupri et al., 2014b), and on abstract algebra* *for university students (Junarti et al., 2019).* | 2 (paragraph 2) |
| 4. | A | Method | 3-4 | Why did the authors choose the level of difficulty to describe the findings? How the tasks used as the instrument in the research method were designed and developed? Were these tasks validated by experts? How to validate? | In the method section, as suggested by reviewers A and D, we have added more information on selection of literature for design, task design, validation process for the designed tasks, research type and procedure, more information about subject of research, process of data collection and triangulation, and data analysis process with its corresponding reasons related to algebraic proficiency. Concerning data triangulation, we have informed that we also collected students’ scratch papers in addition to students’ written answer sheets. We did not do interviews due to Covid-19 Pandemic situation after the written test (school were closed in 2020). We acknowledged this as a limitation of this study in the conclusion section.Below is part of the method section that we have revised:*To investigate students’ algebraic proficiency from a structure sense perspective, we carried out a qualitative case study (Yin, 2015)—which is part of larger study on investigating secondary school students’ algebraic proficiency—with the following three steps. First, we carried out literature study on the theory of and previous research on structure sense for algebra education either for school or university students (Hoch & Dreyfus, 2010; Junarti et al., 2019; Novotna & Hoch, 2008). The theory of structure sense, particularly the three characteristics of structure sense ability (Hoch & Dreyfus, 2006; 2010; Novotna & Hoch, 2008), was used for designing three types of tasks. The tasks and corresponding characteristics of the structure sense used in this study are presented in Table 1. These algebra tasks were theoretically validated by four experts in mathematics education to ensure its appropriateness to secondary school students’ level and to the structure sense characteristics. The designed tasks are on the topic of equations, including quadratic or related to quadratic equations. A general structure of equations designed for this study is of the form* $A^{2}-B^{2}=0$*, i.e., equations of the form of difference of squares. We predicted that Task Type 1 is the easiest one, Task type 2 is more difficult than the Task Type 1, and Task Type 3 is the most difficult one for students.* *Second, we administered an individual written test involving 28 grade XI students (16-17 year-old) after they had been taught the topic of quadratic equations. The students came from the same one class from one of secondary schools in Bandung, Indonesia. The written test, using the three tasks shown in Table 1, was lasted for about forty minutes. In this test, as written in the direction, students were requested to write down their solutions on answer sheets and were not allowed to use calculators or smartphones during the test. For solving each task, we requested students to use two different strategies. For this purpose, two blank spaces below each task are provided for students to put different solution strategies. In this way, we expected students to use both procedural and structure sense strategies in the solution processes. In addition to students’ written work on answer sheets, as part of data triangulation, we also collected students’ scratch papers for helping us in interpreting students’ solution processes.* *Third, in the data analysis, we analyzed students’ written work and their corresponding scratch papers by classifying student solution strategies into procedural and strcuture sense strategies. Through this classification, we decided whether a student applies characteristics of structure sense ability or not for each task. For instance, if the student uses an appropriate substitution for solving the Task Type 2—which concerns a structure sense characteristics, then this is classified as a structure sense strategy. Otherwise it would be classified a procedural strategy. Next, as the results of this classification, we concluded whether students lacked of conceptual understanding or not. A student is considered to be lacked of conceptual understanding if she or he tends to use procedural rather than structure sense strategies, and a student is perceived to have good conceptual understanding if she or he tends to use more eficient structure sense strategies. Students’ success in dealing with the tasks, either using structure sense or procedural strategy, is qualitatively perceived to acquire good algebraic proficiency. If a student does not provide any answer (blank answer sheet), then she or he is considered to provide an incorrect solution. In addition to analyze student solution strategies, we also analyzed student difficulties when students use either procedural or structure sense strategies. Failure in use of a certain strategy in solving a task is considered an indication of student difficulty in dealing with the algebra task and is perceived lack of algebraic proficiency.*Concerning limitation of data triangulation, we have acknowledged this in the conclusion section as follows:*… we acknowledge that this study has several limitations. As we only have students’ written work data, including students’ answer sheets and scracth papers, therefore triangulation of the data for this explorative study is limited. In addition, as this study included a small number of research participants (i.e., 28 grade XI students), we could not make generalization. As a consequence, a larger number of research participants in future research might provide better information about students’ algebraic proficiency in Indonesia.* | 3-49 |
| 5. | A | Method | 3-4 | The authors should more clearly explain how to analyze students’ response in relation to algebraic proficiency related to structure sense. For example, it can be done by investigating the extent to which the students’ responses on the tasks indicate to recognise a familiar structure in its simplest form, deal with a compound term as a single entity and through an appropriate substitution recognise a familiar structure in a more complex form, and choose appropriate manipulations to make best use of a structure. Furthermore, the authors should indicate how the data collected is valid and reliable. In this case, Did the authors examine any interreliability or something like a statistical method to show that the data collected is valid/reliable? Did the authors examine the validity of data by using any triangulation data? For example, to confirm the findings, is there any supporting data such as interviews that convince the data analysis?  |
| 6. | D | Method | 3-4 | In the Method section, it is necessary to explain: the type of research, research procedures, research subjects, types of data, and how to test the validity of the data. The methods were unclear. It would be useful to understand your criteria for evaluating literature. It was also unclear as to whether this was a pilot study or the results of an analysis case studies. In either case, the methodology needs to be more explicitly discussed. |
| 7. | A | Results and Discussion and conclusion | 4-9 | Regarding discussion, The authors have already stated the findings and tried confirming the findings with some previous theories or research findings which are relevant to the structural sense perspective. This is indicated by some citations used to support their claims. For example, the authors stated that the inability of seeing compound terms as single entities suggests student failure to read through and to gain meaning before manipulating algebraic expressions. However, the authors have not yet revealed the unpredicted findings which might be different or even contrast with the previous research. In addition, the authors have not indicated the recommendation on how to deal with those unpredicted findings to future research agenda. This can be solved, probably by providing any schematic recommendation about how to analyze students’ structural sense, or any other analytical framework that future researchers can use. I believe that this paper is potential to be published in JME provided that the authors revise the manuscript by considering these all comments. More detailed comments are inserted in the uploaded file. Thank you. | Regarding this suggestion from Reviewer A, we have added recommendation on how to analyse students’ structure sense for future research in the Conclusion section, as the following.*Concerning unpredicted findings, such as the use of different strategies of structure sense or even the absence of this type of strategy, for future research we recommend to do data analysis using structure sense characteristics in a more specific manner. This can be done for instance by investigating students’ ability more deeply for each characteristics of structure sense, i.e., an ability in recognizing a familiar in its simplest form, in dealing with a compound term as a single entity and through an appropriate substitution recognize a familiar structure in a more compelx form, and in choosing appropriate manipulations to make best use of a structure. In this way, the lens of structure sense is used more sharply in determining students’ algebraic proficiency, particularly in determining students’ acquisition of conceptual understanding and procedural skills.*  | 9 |
| 8. | C | Results and Discussion | 4-8 | Please make sure that your discussion section is suitable and supported by a reputable journal. The “result and discussion” section reports must have the most important findings, including results, analyze as appropriate. The paper must refer to several papers in the Journal on Mathematics Education that are suitable for your research | We have added two relevant references from Journal on Mathematics Education in the Results and Discussion section, as the following:*… The inability of seeing compound terms as single entities suggests student failure to read through and to gain meaning before manipulating algebraic expressions (Arcavi, 1994; 2005; Bokhove & Drijvers, 2010; Hoch & Dreyfus, 2006), may indicate lacked of conceptual or relational understanding (Skemp, 1976) and algebraic thinking ability (Apsari et al., 2020a; Kusumaningsih et al., 2018).* | 6-7 |
| 9. | C | References | 9-11 | Please add more suitable references for at least 30 references from the reputable international journal completely with their DOI | We have added references. Now, this part includes 31 references with its corresponding DOI (for articles from reputable journals, and for books from reputable publishers). | 9-11 |
| 10. | D | References | 9-11 | Furthermore, the author must make sure all references have DOI and follow this guideline to ensure that your final file is complete and in the correct format (<https://bit.ly/33GvXT3>) for preparing their paper strictly. | We have added references. Now, this part includes 31 references with its corresponding DOI (for articles from reputable journals, and for books from reputable publishers). Also, we have followed the format of the manuscript paper. | 9-11 |
| 11. | C | Similarity check | 1-11 | Lastly, the manuscript should also have been carefully revised and similarity checks no more than 20%. | We have revised the manuscript paper according reviewers’ suggestions and have done similarity check via Turnitin, with the similarity is 17 % (see attachment). | 1-11 |
| 12. | D | Similarity check, language, and template/guide line | 1-11 | You can follow the paper that was already published in JME. The fluent, comprehensible, and correct use of English is the main criterion in publishing proven by proofread certificate from a reputable proof reader (attached in revision submission process). Lastly, the recapitulation of the contents of the revised article and similarity check result file must be attached as a supplementary file in the revision submission process. | We have revised the manuscript paper according reviewers’ suggestions and have done similarity check via Turnitin, with the similarity is 17 % (see attachment). Also, this manuscript has been proofread by an official proofreader of the Language Center of Universitas Pendidikan Indonesia (attached). | 1-11 |
| 13. | B | Language Check | 1-11 | asks an English expert to consult the paper. Please see the reviewer's comments on the manuscript. | This manuscript has been proofread by an official proofreader of the Language Center of Universitas Pendidikan Indonesia (attached). | 1-11 |