

CHAPTER V

CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS

5.1 Conclusion

The purpose of the current study was to describe and provide a tentative hypothesis about the algebraic structure sense of high schools of Indonesia as well as identifying the algebraic difficulties that these students face in solving algebraic structure sense equations at grade ten. Students' algebraic expertise has become a concern in and outside Indonesia. This has been seen through students' achievements in national and international standardized test such as PISA, that students have low algebraic expertise and mathematical proficiencies in general. This in turn leads to low educational achievements. The current study is done in order to add literature on high school students of Indonesia algebraic expertise through giving them an opportunity to experience algebraic structure sense material in a descriptive qualitative study. The following conclusions were made from the current study:

1. Grade ten students' algebraic structure sense is still below average. Students are more accustomed to use standardized procedural methods in solving algebraic equations of linear and quadratic nature. The reason for solving equations with standard procedure lie on the material that they are exposed to which are presented during learning and in their textbooks. Most students lack novelty in their way of solving linear and quadratic equations which have structure as they could not invent their own machines in solving the problems.

In addition, students may have all or some kinds of algebraic structure sense, where one may be able to recognise structure in its simplest form but failing to deal with the structure as a single entity or failing to manipulate structure to make best use of structure to solve a problem. In addition, it has been found that students differ in their algebraic structure sense abilities as some students showed algebraic structure sense and some still do not have the expertise despite the fact that these students were in the same grade. In this case, algebraic structure sense material is helpful in exposing students' algebraic expertise and difficulties.

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2. This study also pointed that some grade ten students of Indonesia are fairly flexible in solving algebraic structure sense equation only if given the opportunity to explore their mathematics world with algebraic structure sense problems. It can be concluded that some students are still not flexible in their way of solving algebraic equations of linear and quadratic nature.
3. For algebraic difficulties, it can be concluded that some grade ten students of Indonesia have computational difficulties, misconceptions in the understanding of variables and equivalence relations, misconceptions on algebraic operations with the use of the associative, distributive and commutative properties and some have emotional difficulties such as mathematical anxiety. Some students lack motivation to learn algebraic concepts and some have short memory in remembering algebraic concepts that have been taught. It has also been noticed that similar algebraic difficulties exist between students of the same age and also those difficulties might have originated from earlier levels of education (junior or elementary school). In addition, students often use non-mathematical language to describe a process and reasons for such activities might lie on the teaching and learning experiences that they are exposed to.

5.2 Implications

The current study was important in describing students' algebraic expertise in terms of structure sense. The implications for the process of investigating grade ten students. Algebraic structure sense is that some students have benefited from the study by refreshing their knowledge in algebraic concepts. From this view, it can be said that the study was important in knowing how flexible and creative are some grade ten students of Indonesia are in solving algebraic structure sense equations. The study was also helpful in exposing students' errors and misconceptions in understanding algebraic concepts and processes. This set a foundation for teachers and any other mathematics' stakeholders in rectifying these errors to ensure students' smooth shift in algebraic learning from one level to the other. This will in turn reduce chances of failure of algebraic topics and courses in the near and far future since algebra is the gate keeper to secondary school mathematics and beyond.

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In addition, the current study serves as a guideline for other researchers in the field of mathematics education to set another foot ahead in investigating students' algebraic abilities and design didactics to rectify some algebraic difficulties that both junior and senior secondary school students face in learning algebra. The current study also helped the researcher improve in her expertise in carrying an educational research in mathematics and this is hoped to be foundation for further research on students' abilities to improve their mathematics achievements anywhere. Generally, the current research opened up a communication and relations channel between the researcher, the subjects of research and school authorities to learn about mathematics education in Indonesia that is similar and also differ in some way with mathematics education in the researcher's country of origin, Zimbabwe.

5.3 Recommendations

Viewing from the current research process and results, the following recommendations are made:

1. This research had revealed that high schools of Indonesia might be lacking exposure to material that exposes their algebraic expertise and difficulties. It is therefore recommended that; educators may be innovative in finding and providing algebraic material that encourage students to be creative and novelty in their way of solving algebraic problems.
2. The research findings had revealed that some algebraic difficulties emanate from the learning materials that the students are exposed to in the classroom and from the available learning materials. It is therefore recommended that educators develop the culture of using formal mathematical language and they may emphasize some concepts and processes during learning to reduce leaning difficulties that may become obstacles for mathematics achievements for students.
3. The current research used triangulation of data from written test; interview as well as document studies and results from each data source support the other and differ in some way. This points out to the fact that only single type of assessments is not enough to describe students' mathematical abilities.

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Educators are recommended to include a variety of assessment method that will help them identify students' expertise and needs in mathematics learning a way of ensuring equity of learning. This can be done through continuous Classroom Action Research in the field and documentation of findings in order to improve students' mathematics achievements or by using assessments that encourage mathematical communication like through think-pair and share. .

4. Further research on the current topic points on how can students' algebraic structure sense be improved and which algebraic material are best suited to be used to identify students' algebraic proficiencies. In addition, since this study was done on a small group of students. It is recommended that further investigation be carried out at a larger scale to provide a grounded theory about high schools of Indonesia's algebraic structure sense and difficulties.

5.4 Limitations of the Study

The current research is limited in the way that research was done on small group of students. Findings from this study are based on limited data. The research was also constrained in terms of time and language barriers due to the researchers' condition of being a speaker of foreign language. It is therefore necessary to point out that the results of the current research cannot be generalized to a large population.