

Social Justice in and through Mathematics Education: For Improving the Quality of Mathematics Teaching and Internalising Students' Character Building

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Abstract. Aside from being one of the systematically arranged disciplines, mathematics is also a social construction that views humans as active subjects in building knowledge through interaction with the surrounding environment. Therefore, in addition to being a medium to enhance students' understanding of mathematical concepts, mathematics education should also apply the principles of social activity while linking mathematical concepts to social issues. This research is intended to reform mathematics learning so that it does not merely focus on students' understanding of mathematical concepts, but also improve their quality through the application of 'social justice in mathematics education', while at the same time internalising issues related to social justice through the application of 'social justice through mathematics education' concepts. This study used action research as the research methodology considering its action-based themes and characteristics, where the teacher performed and simultaneously reflected learning activities. The findings obtained from this study are: (i) several challenges related to the application of 'social justice in and through mathematics education' in mathematics learning area, among others, include the difficulty of changing the teacher's mindset on how to teach mathematics to students equitably (socially) and how to foster teacher sensitivity in designing mathematics learning that integrated justice issues into mathematics learning; (ii) the implementation of the principle of 'social justice in and through mathematics education' in order to improve the quality of mathematics learning is felt to be ineffective because of the

teacher's ability to design and implement mathematics learning involving 'social justice in mathematics learning' and 'social justice through mathematics learning' remains adequate; and (iii) the application of 'social justice in and through mathematics education' has a significant effect on student involvement in mathematics learning. It is characterized by more active students in learning and more enthusiastic students in learning activities, because the material that is discussed very closely with students' daily experiences. Furthermore, the findings of this study are expected to contribute to the reform of mathematics education, especially those related to productive mathematics learning, the planting of effective mathematical concepts in students, equitable mathematics learning, and simultaneously internalizing social justice issues through the application of concepts, such as building students' character. By using the elements in the planning and reflection of lessons, teachers are able to develop a comprehensive guide for improving the quality of their lessons and at the same time internalize students' character building by using social justice issues.

INTRODUCTION

The importance of mathematics within society and the current disconnection of mathematics education with the lives of students has resulted in a mathematics education movement that is concerned both with providing equitable access for all students to learn effectively, and in helping students to be protagonists with respect to changing their world in ways that are more socially based (Ball, 2008). Providing equitable access for all students to learn regardless of their background and helping students to be active in learning process are two issues related to social justice in education. Regarding this, Keddie (2011) suggests that schools should provide inclusive environments where marginalized voices are heard (political justice), marginalised culture is recognized and valued (cultural justice) and marginalized students are supported in their academic achievement to successfully reap the material benefits of society (economic justice). Following on from these ideas, social justice involves ensuring that resources are distributed equitably amongst citizens, and that each individual has the responsibility to have mutual respect for others. This idea is expected to make students more aware that they are social justice agents. Therefore, teaching approaches should not be theoretical, involving the introduction of abstract concepts and formulae without paying much attention to aspects related to logic, reasoning, and understanding (Soedjadi, 2000); nor should they rely on the transfer of information from teachers to their students (Somerset, 1997), which can lead to mathematics teaching that is mechanistic with teachers tending to dictate formulas and procedures to their students. Teaching and learning of mathematics should be productive, not focusing only on mathematical contents but also involving mathematical values such as logic, reasoning, and understanding as well as being applicable in daily life activities, which are more specific in students' character building. The research focused on implementing an innovative mathematics teaching strategy which is 'social justice in and through mathematics education' for improving the quality of mathematics teaching and internalizing students' character building. Furthermore, the results of the present study offer a new perspective to teachers for the enhancement of mathematics teaching in Indonesia.

RESEARCH METHOD

The research was conducted in a number of schools. The research subjects were conducted in a small number of schools, from low level, middle to high level clusters in Bandung District, West Java Province, Indonesia, in which included a number of teacher-participants and their mathematics classes. Preparing the research, the researchers conducted a workshop to make sure that all the teacher-participants fully understood how the program would be applied and how the lesson design was prepared.

Research Methodology

The study used action research as the research methodology because of its overarching characteristics. According to Kemmis and McTaggart (1988), action research is a form of collective self-reflective inquiry undertaken by participants in social situations, to improve their own social or educational practices. The overarching aim of this research was to trial, in collaboration with a group of teachers, an innovative framework in the teaching and learning of mathematics at grade 7 in Indonesian schools. The study is a form of collective self-reflective inquiry undertaken by teacher-participants in school situations, to improve their own educational practices. This inquiry sought also to further the participants' understanding of the practices and the situations in which the activities were carried out. The action research is concerned with real situations and is more likely to involve flexible rather than experimental studies, which tend to be more contrived. At each stage of the research, the teachers were supported by the researcher as they developed, implemented and evaluated the program in three cycles to address the research aims. The process involved a repeating spiral of three stages: 1) plan; 2) act and observe; and 3) reflect. As such, the action research, in this study, involved an investigation, where, as a result of rigorous self-appraisal of current practice, the teachers focused on a problem, a topic, or an issue, which needed to be explained. During the action research cycles, the data were collected using multiple research methods that included classroom observations, interviews, teachers' reflective journals and the researcher's journals. On the basis of this information, the teacher then planned, implemented and evaluated an action, drawing conclusions on the basis of the findings (a sequence recommended by Macintyre, 2000). The research involved senior high school students from three types of schools, low, middle, and high-level criteria. For implementing the research involved three mathematics teachers (one of whom was selected from each school) and their classes.

Data Analysis

Merriam (2009) states, that data analysis is the process of making sense of the data in order to address the research questions. As such, the data analysis in this study involved organizing what we see, hear and read, whilst referring to the research aims. Analysis and interpretation of the data carried out throughout the study and commenced while the data were being collected. Prior to the data analysis, all recorded results were transcribed and verified by the teacher-participants. Data collected during classroom observations were categorized and analyzed with respect to the program and the research aims. Students'

impressions, comments and opinions about the implementation of the program, obtained from focus-group and in-depth interviews were grouped together based on their responses and with respect to the research aims. The results of both focus-group and in-depth interviews were categorized and analyzed based on the types of responses and with respect to the research aims of the study. In addition to classroom observation and interview, teachers' reflective journals and the researcher's journals were employed to support and confirm information obtained from both of these collecting data instruments. The most important issue in evaluating the rigor of qualitative research is trustworthiness. The researchers used Guba and Lincoln's criterion of trustworthiness as one of the three approaches that are appropriate to the fourth generation evaluation, which embraces credibility, transferability, dependability and confirmability (Guba & Lincoln, 1989). The researchers also used Yin's recommendation of building trustworthiness and credibility of the research by embracing transparency, methodic-ness and adherence to evidence (Yin, 2011).

RESULT AND DISCUSSION

The research focused on implementing an innovative teaching strategy, which is 'social justice in and through mathematics education' as a means of reforming teaching in mathematics classes and to examine the development of students' awareness of social justice in learning of mathematics. Over the course of the action research cycles, the teachers used social justice principles to improve the quality of their teaching. Although they generally agreed that social justice was important, classroom observations indicated that the implementation of the program was carried out with varying degrees of success. Despite the teachers' attempt to include social justice principles and at the same time internalize social justice through teaching, the classroom observations indicated that the principles were not always used in their teaching. Teachers' reflective journals confirmed that their teaching style was not easy to change, even though they recognised that the framework is a good idea to improve the quality of teaching and learning. Data obtained by teachers' reflective journals and researcher's journals indicated that there were a number of challenges faced by all of the teachers that influenced the degree to which they were successful, including the need for teachers to change their mind-set and understand the principles, their skills in planning and implementing the practices associated with the principles. In addition, based on both teachers' reflective journals and researcher's journals, the teachers found that the time constraints made implementing the principles of social justice difficult. Classroom observations and focus-group interviews also indicated that, over the course of the action research cycles, teachers attempted to improve student interactions both with themselves and with their peers. They worked to change their interactions with students. Firstly, the teachers moved away from "dominating" the class to "facilitating" students' learning process. After the introduction to the principles of social justice, the teachers encouraged students to help to refine their ideas with comments. Additionally, the teachers attempted to: include all members of the class in all learning activities; invite all students to respond to questions and to comment on the ideas of others' responses; show appreciation to the responses of all members of the class and encourage students to help their peers to refine their ideas. Over the course action research cycles the interactions among students gradually increased as students became more confident and familiar with what they needed to do during group settings. Another change made by the teachers was that they consciously refrained themselves from commenting on the students discussions

during group work. Rather than make comments or provide answers, the teacher encouraged the students to ask questions about the topic if they did not understand. Over the course of the three action research cycles, students became more likely to make positive comments about their mathematics classes and less likely to make negative comments. The implementation of the framework had helped the teachers to create a classroom that was socially more just. Despite this, the changes in their classrooms, in terms of social justice, were still remarkable. Not only were all of the students engaged in a rich learning process that provided scope for deep mathematics learning but it also engaged all of the students by making the learning relevant. In the last action research cycle, the number of positive comments increased over the course of the three action research cycles with students at the third research cycle being more likely to express their enthusiasm in learning mathematics, their enjoyment of mathematics, their reduced fear of mathematics and increased understanding of mathematics concepts. The teachers agreed that making mathematics accessible and relevant was important in terms of social justice in the classroom. This portrays a lesson in which the teachers made the lesson both relevant and accessible to the students, thereby increasing the access to mathematics lessons. It was representative in terms of the depicting the improvement in social justice across all of the teachers' mathematics classrooms. As such, all of the students had an opportunity to be involved in the learning process and were able to contribute to the activity and to help to resolve the problems. This supported the notion that the implementation of the framework improved the level of social justice within the mathematics classes. In addition, the result of the study also successfully internalised social justice issues through mathematical concepts for building students' character. By using the elements in the planning and reflection of lessons, the teachers can develop a comprehensive guide for improving the quality of their lessons and at the same time internalize students' character building using social justice issues. All these changes engaged the student's and allowed them to express their affective reactions such as interest and enjoyment.

CONCLUSIONS

The conclusions of the study highlighted the presence of several challenges related to the application of 'social justice in and through mathematics education' in mathematics learning, among others, such as the difficulty of changing the teacher's mindset on how to teach mathematics to students equitably and how foster teacher sensitivity in designing mathematics learning that integrated justice issues into mathematics learning. The implementation of the principle of 'social justice in and through mathematics education' for improving the quality of mathematics learning is felt to be ineffective because of the teacher's ability to design and implement mathematics learning involving 'social justice in mathematics learning' and 'social justice through mathematics learning' still not adequate. The application of 'social justice in and through mathematics education', however, has a significant effect on student involvement in mathematics learning. It is characterized by more active and more enthusiastic students in learning activities because the material discussed resonated with their daily experiences. In addition to make a contribution to those seeking to improve the quality of mathematics teaching (as well as mathematics learning), the result of the study also successfully internalized social justice issues through mathematical concepts for building students' character. By using the elements in the planning and reflection of lessons, teachers were able to develop a

comprehensive guide for improving the quality of their lessons and at the same time internalize students' character building by using social justice issues. Applying the 'social justice in and through mathematics education' framework in mathematics classes demonstrated its overall usefulness and provided lessons from which further use of the framework might build upon. Additionally, the results of the study are expected to be valuable in making decisions and conducting professional development, for teachers in particular, for improving the quality of mathematics teaching and learning as well as building students' character.

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