

Promoting Teaching and Learning of Mathematics Integrated with Social Justice Issues

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Abstract

The aim of this paper is developing a sense of social justice in Mathematics education in Indonesia through promoting teaching and learning of Mathematics integrated with social justice issues. Mathematics should be longer than just a subject taken exclusively only by certain people, Mathematics should be for all. If we insist that Mathematics be part of the core curriculum for all of students, then we must make it as a fundamental right that all of students involve in learning Mathematics. Therefore, teaching and learning of Mathematics should let all of students, whatever their background, enjoy and understand Mathematics. A Mathematics teacher should expose the students, whoever they are, based on their different varieties, capabilities, and interests. By this approach, actually teaching and learning Mathematics has begun to introduce social justice issues to students. In addition, topics or themes of Mathematics lessons are concerned to social justice issues which are actual and familiar with students' experiences. Throughout promoting social justice issues integrated with teaching and learning of Mathematics, students are encouraged to increase their socio political consciousness and help them to develop a positive social and cultural identity, and at the same time they recognise and aware that a lot of values and principles of Mathematics are applicable to daily life activities. Social justice formation values inculcated in the individual help one to become a good and successful member of the society, and Mathematics develops someone a proper attitude, as there is no space for prejudiced feelings, biased outlook, irrational thinking, and discrimination. Therefore, school Mathematics curriculum should concern and include social justice issues as a part of its content. Regarding this discourse, school Mathematics curriculum should have at least two key principles: (i) provide opportunities for all students to learn and to achieve their Mathematics achievement; and (ii) promote students' understanding about social justice in preparing all students for the opportunities and experiences of social justice issues.

Background

Based on my personal observation of Mathematics education for several years, teaching-learning of Mathematics in Indonesia is mostly considered to be linear and repeated practice. Teaching-learning of Mathematics almost never gives students opportunities to articulate and construct their own understanding of what they learn. It is contradictive with the assumption that students inevitably construct the correct internal representation from the materials presented implies that their learning is triggered by the mathematical relationships they are to construct before they have constructed them (Cobb, 1987; Gravemeijer, 1991).

In many cases in Indonesia, students have not really learned Mathematics yet. Most of Mathematics teachers have not sufficiently known how students should learn Mathematics and what should they do to make their students “doing math”. Their teaching orientation is mostly to finish the Mathematics curriculum by the end of school year. Most of them teach in ways that relied on Mathematics textbooks. In the classroom they followed the textbook, without considering the correctness or otherwise of the Mathematics that students wrote in their books (Somerset, 1997). The textbooks and classrooms activities only memorising the facts and students are asked to practice and just follow, even imitate, what their teacher did. The key words ‘learning by doing’ and ‘competency’, in the context of teaching-learning of Mathematics, were inadequately explored and insufficiently addressed. On the other hand, one of the impacts of a Mathematics teaching ideally is students’ understanding about the application of mathematical values and principles in daily life activities.

As the impact of mostly Mathematics teachers’ teaching style, not many students who are interested in Mathematics, learn Mathematics meaningfully, understand and enjoy learning Mathematics, and know what Mathematics is. Most of students pre-

dominantly just do it what they must do without adequate understanding about the essence of the Mathematics subjects when they are learning. In this situation, teaching-learning of Mathematics process tend to be mechanistic. Whereas the effect of a Mathematics teaching should develops students’ mathematical knowledge and encourages students’ engagement in teaching-learning of Mathematics.

Until now Mathematics is still the most dreaded of school subjects, leading to a widespread sense of fear, anxiety, and failure among students. Whereas affective refers to students’ feelings about Mathematics, aspects of the classroom, or about themselves as learners of Mathematics (Reyes, 1984). Teaching and learning Mathematics has not been belongs to everyone with any background, including socioeconomic background. Because of their “limitation”, students who come from low socioeconomic background do not have enough access and facilities, such as books, media and teaching aids, and other learning resources, to get ideal Mathematics teaching-learning process.

Considering the fact above, Mathematics education, teaching-learning of Mathematics in particular, in Indonesia must be reformed. Because it is counterproductive with the essence of Mathematics education itself, as Nunez et al. (1997) argues that an important goal of Mathematics education is to understand the thinking involved in doing and learning Mathematics. The reform of teaching-learning of Mathematics, requires not only to the introduction of instructional sequences and learning activities but also to the roles of teacher in social and socio-mathematical norms. In the future, teaching-learning of Mathematics, particularly in Indonesia, should more challenge students to move on from their current, as passive objects of teaching, to active subjects of learning. As a consequence, the teacher would change the position from an authoritarian and instruction-oriented towards a supportive and student-centred. But, based on many facts, of course not all innovative ways could be

smoothly implemented. That is why we also need to consider and try to overcome the difficulties, problems, and obstacles in implementing the approach of teaching-learning.

The Nature of Mathematics and Mathematics Education

Mathematics as an academic subject can serve students' learning only if and when its rigor, beauty, and pertinence are communicated clearly. In short, students and the Mathematics they learn ought to be respected more fully than has typically been the case (Schmidt, 2011). Therefore Mathematics should be more than just a subject taken exclusively only by certain people. Furthermore, Mathematics education in general, and Mathematics in particular, will become more equitable as the class structure in society becomes more equitable (Frankenstein, 1995).

In Mathematics, as in other cognitive fields, affective domain can play an important role in students' decisions about how much Mathematics they will need in the future and how they approach the mathematical content they do study (Reyes, 1984). Mathematics should not be just considered as a classroom discipline. As argued by Davis and Hersh (1981) that we should stress that the experience of a world structured by mathematical relationships is, in our view, a central aspect of meaningful mathematical activity. However, this matter should be recognised and considered by any Mathematics teacher.

If we insist that Mathematics be part of the core curriculum for all students, then we must make it as a fundamental right that all students enjoy learning Mathematics. The practice-linked Mathematics that emerges might then serve as a starting point in the learning-teaching process (Ekeland, 1988; Tymoczko, 1986). It is clear that either teaching-learning of Mathematics or 'doing Mathematics' which is considered joyful and useful for our daily

lives. Nevertheless it will surely not satisfy the taste of all their students, but at least helping them use Mathematics as a foundation to learn other subjects.

Hoyles, et al. (1999) state that critical Mathematics educators argue that one of the central aims of the school curriculum should be a concern to understand the place, purpose, and power of Mathematics in society. Similar to this argument, in order to be meaningful, Mathematics must be shown to students to be applicable in a real sense (Edgecombe, 2011; Saxe, 1991). When mathematical ideas are connected to each other or to the real-world phenomena, students can begin to view Mathematics as meaningful, useful, relevant, and integrated entity.

The way of Mathematics is not a system of handling mathematical operations but rather the ability to know, understand, and construct the values of Mathematics. Cobb et al. (1992) claim that Mathematics educators almost universally accept that learning is a constructive process. Students should be allowed to follow their own paths and decide what they want to do. And, Mathematics must be made meaningful, useful, relevant, and integrated, rather than only decoded.

In accompanying the construction of mathematical values and principles, students should be encouraged to think mathematically. However, just knowing Mathematics symbols and procedures facilitate to solve computation matters but it does not automatically make students are able to think mathematically until opportunities for understanding the meaning are sufficiently provided. This reveals mathematical thinking as a blend of differing knowledge structures (Tall, 2008). Moreover, according to Ma (1999) the real mathematical thinking should be going on in a classroom. It proves that Mathematics education is obviously an important entity in the current and our future lives. Even Hoyles et al. (1999) predicted that Mathematics education in the third millennium will not just be about teaching-

learning of Mathematics, but about the nature of knowledge and the place of Mathematics within society. In short, teaching-learning of Mathematics should touch social aspects, such as social justice issues.

Active Learning Mathematics

The key aspect of Mathematics classroom has to be the recognition of students' ability to develop mathematical ideas and concepts based on their own previous ideas and experiences and modify them in the process of interactions. Students should be encouraged to preserve their thinking, curiosity, and keenness to learn. We would view it as an activity in which we guide students' constructive efforts, thereby initiating them into taken-as-shared mathematical ways of knowing (Cobb, et al., 1992).

According to Bauersfeld, et al. (1988) learning would be viewed as an active, constructive process in which students attempt to resolve problems that arise as they participate in the mathematical practices of the classroom. Similarly, Cobb et al. (1992) argues that learning is described as a process in which students actively construct mathematical knowledge as they strive to make sense of their worlds.

Based upon the constructivist idea, knowledge cannot be imposed on students but must be developed in a natural process of construction, deconstruction, rebuilding, repairing, is difficult to establish within an absolutist framework. The assumption of rational constructivism is that, by being rational, scientific development represents a benign growth (Skovsmose, 2000). Refers to this idea, students should be able to navigate their lives in this current world. In its implementation, however teacher should consider that students vary in background knowledge. The different knowledge background can be important for students. It is depending on their interest and non-academic areas of their life, it is academic background knowledge that

most affects a future tied to academic achievement (Marzano, 2007).

A Mathematics teacher must give more opportunities to students to construct options that are in conformity with the goals of teaching program for them to choose from. Furthermore, Sierpinska et al. (1996) suggests Mathematics teachers to intensively observe anything happens during teaching-learning process in the classroom. It is important, because by this way we are able to evaluate how effective the process of the teaching program.

Social Justice and Mathematics Education

Absolutely, there is no person who want to be born as an underachiever. Everybody wish to be a smart, clever, or intelligent person. Unfortunately, in fact, underachievers in many cases are "unlucky persons", even they are often marginalised. There is a gap between "the lowest" and the "the highest", between underachievers and upperachievers. Regarding this matter, skeptics argue that underprepared students need more time-in and out of class-to master competencies required. More generally, the notion of providing developmental coursework to underprepared students in an accelerated fashion seems counterintuitive (Edgecombe, 2011).

Other relevant study conducted by Scheirer and Kraut (1979) examined the self-concept literature for evidence of a causal effect of self-concept on academic achievement. Concerning this regard, education world, schooling in particular, should develop new strategies since the beginning to overcome or minimise the achievements gap between the highest achieving and the lowest achieving students. By this approach, indirectly education has begun to introduce a social justice issue to students.

Social justice issues are often constructed as concerns related to the participation of social group in social activity and their enjoyment of their fair share of social benefits. This focus on responsibility establishes social justice concerns as moral obli-

gation, rather than charity, good will or convenient politics (Atweh et al., 2009). Regarding to the matter, social justice recognises that there are situations where application of the same rules to unequal groups can generate unequal results. In contrary, equal opportunity, as a part of social and cultural identity, is concerned with treating all people equally and providing people with equal rights or giving everyone “fairness”.

Equal opportunity rights are applicable to everyone, while social justice targets the marginalised groups of people in society that focuses on the disadvantaged. Equal opportunity and social justice associated with availability, accessibility, affordability, acceptability, and adaptability. There are some suggestions that many current attempts at reducing social exclusion, do improve the situation for the most marginalised, yet at the same time do an even better job for the most affluent leaving the gap even wider (Gates et al., 2009).

Concerning the orientation of social justice in teaching and learning, suitable and various teaching strategies, methods, and approaches, should be considered as an important matter in developing their sense of social justice agency. In addition, we can also integrate social justice issues into the lessons connected with the topics or themes of teaching in learning activities, classroom worksheet, Mathematics projects, and homework or journal assignments.

By this way we encourage students to have a sense of social justice agency. However, the sense of social justice agency is also important for students to understand equity (or equal opportunity) issues. It is imperative that we understand exactly who is being left out and left behind, both economically, culturally, politically, and socially.

Come from another side, Reay, et al. (1995) suggest that far from getting better, social injustice measured through a deepening of educational and social stratification is actually getting worse. Whereas social justice is a philosophical definition

of justice, that is, giving individuals or groups their due within society as a whole. It will be also assumed that this includes the notion that all people deserve an equal opportunity to succeed. Hence, teaching-learning for social justice is an educational philosophy designed to promote socioeconomic equality in the learning environment and instil these values in learners. Equity to require not just equal access and opportunity, but also equal outcomes (Lesser, 2007). Yet, a social justice instruction is aimed to promote unity on where the learners live and also decrease or even erase boundaries to the general curriculum. These boundaries often include student’s achievement, race, ethnic, social class, socioeconomic status, learning ability, gender, and so forth. Moreover, through social justice instructions, students would be able to implement what they have experienced regarding social justice issues in school situation into their daily life activities.

In addition to promote unity and decrease the boundaries, teaching-learning for social justice should be designed to educate equality in learning atmosphere based upon students’ background of learning style, learning motivation, talent, interest, gender, culture, socioeconomic status, social class, ethnic, and other relevant things. Hence, social justice instructions have to be able to minimise the gap of students’ backgrounds to a general curricula. A teacher should engage social justice through their teaching that ensure their students not only thrive academically, but also socially. Throughout promoting social justice pedagogy, students are encouraged to increase their socio political consciousness and help them to develop a positive social and cultural identity. Teaching towards social justice involves preparing students to succeed in whatever context they find themselves, including contexts that privilege and value the dominant narratives, the mainstream culture, the “traditional values”, and the rules for succeeding that often are unspoken and taken-for-granted (Kumashiro, 2009).

With regard to social (justice) issues in culture of society, obviously Mathematics has a lot of contributions through its mathematical-social values. Many of students began the process of developing socio-political consciousness and a sense of social agency through using Mathematics (Gutstein, 2006). Social agency in a broad sense and our thinking about social justice in school Mathematics draws on a variety of perspectives. When Mathematics fulfills this role of helping students to better understand the needs of their world and to develop appropriate and creative ways to meet those needs, namely humane Mathematics in which Mathematics teaching-learning is explicitly designed to guide students to make good sense of and make positive change in their world (Schmidt, 2011).

Through this teaching-learning of Mathematics integrated with social justice issues, students' view and feeling about Mathematics, whoever they are, are more positive. Concerning this issue, a study argues that it is likely that a student who feels very positive about Mathematics will achieve at a higher level than a student who has a negative attitude toward Mathematics. It is also likely that a high achiever will enjoy Mathematics more than a student who does poorly in Mathematics (Reyes, 1984). Therefore, teaching-learning of Mathematics should let students understand and enjoy the beauty of Mathematics. As some people claim that mathematics is art with its aesthetic values, recognize that Mathematics is beautiful. The aesthetic, elegance, gracefulness, beauty, fineness, and harmony within mathematical values are assumed as part of the nature of a harmonious life in society, and it is one of social justice issues: living in harmony. Mathematics begins to serve a different social function; such as obtaining any access to significant Mathematics that decisively shape our current society. It has become widely accepted that the learning and practice of Mathematics are not purely intellectual activities, isolated from social, cultural, and contextual factors (Cobb, 1994; Lave, 1988; Confrey, 1995).

In acknowledging the interplay between Mathematics and human experience we begin to understand how Mathematics works in, and on, society. Nevertheless, functional Mathematics is not being introduced to prepare critical persons who appreciate the social justice dimensions of mathematical applications. The aim is more one of formatting of training the future workforce with the skills that our politicians tell us we need to guarantee future economic prosperity (Skovsmose, 1998). Regarding this discourse, Howlett and College (2008) argue that schools could become dynamic instead of reflexive agencies; as instruments of reform schools could search out and reinforce concrete patterns to remake society in the name of peace while at the same time enabling each student to realize his or her potential for building a nonviolent world. Further, Osler (2007) argues that the aims of studying issues of social (and economic) justice in Mathematics classroom are understanding issues of social, political, and economic (in)justice through a mathematical framework and developing realistic and mathematically-sound solutions to address social (and economic) justice problems.

The study of Mathematics helps an individual in social justice formation in many ways. Mathematics develops someone a proper attitude, as there is no space for prejudiced feelings, biased outlook, irrational thinking, and discrimination. It makes one in objective analysis, correct reasoning, impartial judgment, and valid conclusions. These social justice formation values inculcated in the individual help student to become a good and successful member of the society in the future. As Guststein (2006) claims that Mathematics equips students with uniquely powerful ways to read and write (describe, analyse, and change) the world.

More specific in Mathematics education, argued by Atweh et al. (2009) that the quality of Mathematics education is measured not as, formal abstraction and generalisation, but by its capacity to transform aspects of the life of the students both as

current and future citizens. Students need to be prepared through their Mathematics education to investigate critique injustice, and to challenge, in words and actions, oppressive structures and acts—that is, to ‘read and write the world’ with Mathematics as claimed by Gutstein above. In teaching practice, a Mathematics teacher should appreciate and completely understand the role of school Mathematics, so that in turn students come to appreciate how Mathematics works in society. If such a shift is to translate into actual educational practice in schools, it seems clear that certain political, socio-cultural, and curricular conditions need to be in place (Noyes, 2007). In supporting this idea, Ernest (2007) claims that teaching-learning of Mathematics seems to occupy a special place in the provision of social justice or its obstruction within the education system.

Enacting social justice issues through teaching-learning of Mathematics appears reasonably possible within the general schooling and curricular context for teachers in the school system. There is a dialectical relationship between developing mathematical power and teaching students to use Mathematics to study, and potentially change, structural inequity. The two processes can facilitate each other, under certain conditions (Gutstein, 2006). The quantitative power of Mathematics can provide tools to uncover social in-justice by quantitatively analysing real-life situations.

One of the purposes of this paper is to encourage students with the development of their social agency by helping them develop social justice understanding and sensitivity. Through this discourse, students are involved to understand about social justice integrated in teaching-learning of Mathematics, more general in Mathematics education, in two ways, social justice in Mathematics education and social justice through Mathematics education. Some of themes concerning social justice issues integrated with Mathematics ideas among others are: (i) transportation, fuel consuming, pollu-

tion, and public health; (ii) population, poverty, crime, and health issues; and (iii) school environment, school size, students’ need, teaching-learning process, and students’ achievement.

For instance, although mostly all people need transportation (vehicles) in their daily life activities, but, on the other hand, modern transportation, in any modes, consumes fuel or petrol. The vehicles that use fuel cause pollution, and, however, the pollution influence public health. Through this theme students can use Mathematics “expressions” such as tables and diagrams to show the percentage of fuel consuming of each vehicle. In addition, they are able to measure the effect of pollution to public health, and this activity can be formed in group project through field exploration. At the end of this activity students in group present what they did in any forum, either in school or any out of school events.

According to Osler (2007) the benefits of integrating social justice issues into Mathematics curriculum for students are: recognising the power of Mathematics as essential analytical tool to understand and potentially change the world; deepening understanding of local, national, and global issues; engaging in high-level thinking about ‘Big Mathematical Ideas’; encouraging become more motivated to learn Mathematics; participating in actual community service projects and organizing campaigns; answering the question: “Why do I have to know this?”; and developing critical thinking and problem-solving skills.

Moreover, how to integrate social justice issues into Math class? Concerning this matter, Osler (2007) suggests us to consider: (i) start lesson with a strong mathematical framework, (ii) talk to students to decide on the issue to focus on, (iii) create some essential questions, (iv) start by introducing social justice issues, (v) begin introducing Mathematics values, (vi) choose Mathematics topics associated with social justice issues, (vii) scaffold both Mathematics and social justice issues, (viii) end with a

great project related to integration of Mathematics and social justice, (ix) provide opportunities to students to share and present their work.

Again, Mathematics should be longer than just a subject taken exclusively only by certain students, but Mathematics is for all of students. We must make it as a fundamental right that all of students involve in learning Mathematics. Whatever their background, they should enjoy and understand Mathematics. In addition, topics or themes of Mathematics lessons are concerned to social justice issues which are actual and familiar with students. Throughout promoting social justice issues integrated with teaching and learning Mathematics, students are encouraged to increase their socio political consciousness and help them to develop a positive social and cultural identity. Therefore, school Mathematics curriculum should be also concerned to social justice issues. Regarding to this discourse, the Mathematics curriculum should have at least two key principles: (i) provide opportunities for all students to learn and to achieve their Mathematics achievement; and (ii) promote students' understanding about social justice in preparing all students for the opportunities and experiences of social justice issues.

In Indonesia society, some people who are short of Mathematics understanding, are facing various kinds of problems and are easy to be cheated.

But in Indonesia some teachers do not pay attentions to daily life issues and social justice in teaching mathematics.

So it is very important to connect Mathematics and daily life. In Mathematics curriculum teaching contents should be more concerned with daily life topics. Using these contents children study the importance of Mathematics and social justice.

Mathematics is important and useful to make childrens' life happier with learning social justice.

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