DESIGNING CONTEXTUAL LEARNING STRATEGIES FOR MATHEMATICS FOR JUNIOR SECONDARY SCHOOLS IN INDONESIA

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Statement of Authorship

"Except where reference is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis submitted for the award of any other degree or diploma.

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All research procedures reported in this thesis were approved by relevant Ethics Committee (Australian: FHEC No. 532-04; Indonesian: FHEC No. FESES#2).

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Abstract

This study examines the effectiveness of realistic mathematics teaching approaches for junior secondary schools in Indonesia. The students' materials have been adapted from *Mathematics in Context* (MiC, 1997a). *Mathematics in Context* is a mathematics curriculum developed in the USA, which was essentially based on the realistic mathematics education (RME) theory (De Lange, 1996, Meyer, 2001). These teaching approaches use a familiar context as a starting point to learn mathematics. Students are 'mathematizing' by investigating, formulating, schematizing, as well as modeling the situation. This teaching approach is more student-centered. The students are requested to *re-invent* known mathematical relationships, formulas, rules, and concepts. The term *guided-reinvention* in this theory of learning is central. Hence, the students' materials which provide the learners the opportunity to *re-invent* mathematical concepts would be very important to lead them to develop deeper mathematical understanding.

There are several stages of data collection and analysis. After completion of the pilot study, the main research was conducted. To introduce the RME, Professional Development (PD) training had been conducted. Prior to the PD session, the teachers were asked their perception toward innovation of mathematics instruction. Then eight mathematics teachers of Year-8 were selected to implement the RME teaching approach in two levels: full intervention and half intervention. Another four teachers were randomly selected as reference group. Data collection techniques include pre and post tests, classroom observation, interviewing students and teachers, surveying teachers, daily journal, and questionnaire about the students' attitudes towards mathematics.

Data collected show the effectiveness of this teaching approach. It means that the teaching approach significantly improved the students' achievement as well as students' attitudes toward mathematics. The PD session gave the teachers inspiration to alternatively change their teaching practice. Some constraints and barriers in implementing this approach were the time needed to cover this teaching and to learn more about this approach, availability of the materials, and the curriculum target that should be completed during the academic year. The RME approach is promising, needs to be considered as an alternative teaching approach for junior secondary school in Indonesia.

Table of Content

List of Tables

List of Figures

Selected Appendices

(Other Appendices on accompanying CD—see list on page xvi)

[PS = Pilot Study, MS = Main Study]

List of Appendices on CD only

1 Background to the Study

1.1 Population and Educational Systems

Indonesia is a country with thousands of islands spanning out from the West (Aceh, Sumatra) to the East (Marauke, Irian Jaya). It is located between two oceans, the Pacific and Indian, and two continents, Asia and Australia (see Figure 1). Moegiadi and Jiyono (1994) predicted that by 2000, the population would be about 210 million residents. In fact by 2003, the population had grown to 215 million (Suara Merdeka, 26/08/2003; Kompas, 18/2/2003).With such a big population, and its abundant natural resources, Indonesia is attracting world-wide attention. Many foreign investors are interested in investing their capital in Indonesia. This needs to be made attractive by improving the quality of human resources in all sectors, including the educational sectors (Departemen Pendidikan Nasional, 2003). So attending to the need of the educational sector has become an important task.

Figure 1: Indonesian Archipelago

Indonesia is a developing country, which is now looking towards more developed countries for ways to advance its educational system. Use is being made of collaborative studies among universities and between any two governments in various sectors. For example, foreign experts are sent to Indonesia, or Indonesian scholars are sent overseas to take further study areas like education, health, agriculture, science and technology.

In the educational sector in particular, Indonesia is now increasingly interested in learning about the current international trends and is gradually becoming more aware of the changing focus of the teacher's role in the classroom, moving from the teacher-centered approach in which the

teacher dominates the class to an approach in which the teacher empowers the students to participate actively in the classroom.

To give a brief description of the Indonesian educational systems, an overview is presented in Figure 2 (Moegiadi & Jiyono, 1994).

The junior secondary school, of particular interest in this project, spans three years and caters for 12 –15 year old students.

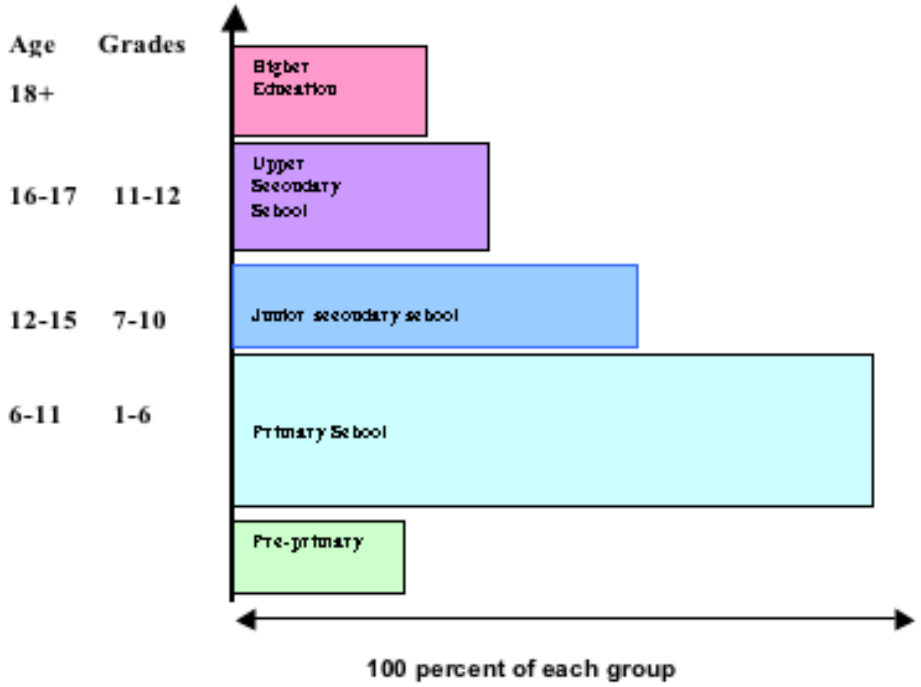

Figure 2: Structure of formal education system in Indonesia

(Moegiadi & Jiyono, 1994).

In 1988-1989, there were 20,334 junior secondary schools with 6.8 million students and 467,122 teachers (Moegiadi & Jiyono, 1994). By 1998, the number of junior secondary school students reached more than nine million (Departemen Pendidikan Nasional, 1998).

Considering the fast growing number of students, if the quality of education is not maintained or improved, poor educational outcomes are inevitable; so the improvement of the quality of education is a must. Improvements are needed not only in the quality of teaching and teacher training but also in the components of education which support the system, such as existing infrastructure, the availability of facilities, high interest of students, and high quality of teaching methods.

1.2 Teachers and Teacher Training Education

In the junior and senior secondary schools, subject matter specialists are used. The teachers only teach specific subjects; for instance, mathematics subjects are taught by specialist mathematics teachers. However, during the period of teacher training education, the teachers take a range of subjects, and study subject areas which are relevant to their tasks at school.

Mathematics teachers of junior secondary school are taught and trained in state and private teacher training colleges. According to Brodjonegoro (2003) most training programs follow the concurrent model, i.e. the pre-service training program and mathematics are taught concurrently.

The curriculum structure of the teacher training program of mathematics covers: (1) content knowledge of mathematics: algebra, geometry, statistics, topology, calculus and computing; (2) pedagogical knowledge: teaching methods, educational research and evaluation of education; (3) general knowledge: moral education, religious education, environment, and citizenship; (4) psychology of education, and (5) administration and management of education (Gaffar, 2004). Previously, the qualification for a junior secondary teacher was three years of training (Diploma-3), but now the minimum qualification for junior secondary teachers is a four-year degree (S-1, Sarjana degree). The student teachers in a teaching college learn not only the theoretical aspects of a subject but also its practical applications. Students majoring as mathematics teachers, for example, have to teach in the practical area in both junior and senior secondary schools. They learn how to teach and interact with junior secondary students in classrooms. They also learn how to assess students' mathematical understanding. They have to apply their content and pedagogical knowledge of mathematics in the school setting. These activities commonly take place for about one semester (14-16 weeks) at a school, supervised by an educator in the mathematics area and a master teacher at the school. The activities are designed to orient and adapt a student teacher towards becoming 'a teacher', and involve teaching practice, whether supervised by a master teacher or not, developing instructional media, managing the classroom, and other educational tasks at the schools. At the end of the practical tasks, the aspiring mathematics teachers are required to demonstrate their teaching ability in the classroom as the final test (Gaffar, 2004).

1.3 Change in Compulsory Education from 6 years to 9 years

Beginning in 1994, changes in compulsory education have been implemented in the Indonesian Educational system (Departemen Pendidikan dan Kebudayaan, 1994; Daliyo, May, Guest, & Tirtosudarmo, 1998; Hinduan, Hidayat, & Firman, 1995). Previously, compulsory education was for six years, i.e., only up to the primary school level. Since 1994, all students who complete primary schools must enroll in a junior secondary school. This change has resulted in a dramatic increase in the participation in the basic education program (primary and junior secondary school levels), for example from 36.44 million in 1994 to 39.01 million in 1997 with further growth since then (see Table 1.1).

Level	Student's Participation in Education

	(Pure Participation Index)- Number in million		
	1994	**1997**	**1998**
PS	29.46 (93%)	29.27 (94.96%)	29.10 (93.74%)
JSS	6.98 (39.9%)	9.73 (55.92%)	9.54 (55.05%)
Total for Basic Education	36.44	39.01	38.64(*)

Table 1.1 Pure Participation Index in the 9-Year Compulsory Education

Source: Departemen Pendidikan Nasional (1998)
Note: Basic education consists of primary and junior secondary schooling

(*) this drop in participation may be due to the political chaos that accompanied the natioan leadership succession in the 1997/1998.

This change has brought new challenges for the Indonesian government to provide good facilities to support the period of compulsory education.

Based on the experiences of other countries, Fisher (1998) suggests that the government should at least provide a strong infrastructure, provide adequate buildings and spaces for all students, and re-train and re-fresh the teachers with new teaching and learning paradigms which will enable them to teach students in the 21st century. Appropriate books and equipment facilities should also be provided by the government, so that the students have the opportunity to learn mathematics actively. However, this leads to some problems regarding the readiness of the people involved in the educational system to support the nine-year compulsory education program, such as "Are teachers ready to teach with the new teaching and learning paradigm? Are the books and facilities appropriate for the students to learn using this new paradigm? Are the infrastructures ready to execute a nine-year compulsory education elsewhere with different approaches from the previous teaching and learning strategies?" Some of these questions are addressed as problems of this research project.

1.4 Students' examination results

The scope of the problem facing educational authorities regarding students' accomplishment in mathematics is indicated by students' achievements in examinations at national and international levels.

Junior secondary students are typically aged 12-15. Within the Indonesian setting, the junior secondary level has to serve about nine million students (Badan Pusat Statistik, 2003). On average, these students' academic results in mathematics have been poor: their mean scores in junior secondary mathematics examinations at the national level were about 4.00–5.00 on a scale of 10 from 1989 to 1995 (Manan, 1998); and the results of UAN (National Final Exam) in

mathematics[1] in the Province of West Java decreased from 5.61 (in 2000) to 5.06 (in 2004) (Dinas Pendidikan Nasional-Jabar, 2004)

At the international level in the Third International Mathematics and Science Studies-Repeat (TIMSS-R, 1999) , Indonesian students also recorded a low achievement in mathematics and sciences. Among the 38 participating countries, Indonesian students were placed 34th in mathematics and 32nd in sciences (TIMSS-R, 1999).

Findings such as these led me to question whether junior high school students in Indonesia are able to achieve better in mathematics, and what might be a major cause of problems with mathematics in the Indonesian educational system. This motivated me to question whether introducing a new teaching approach might improve the quality of the students' achievement in mathematics.

1.5 Curriculum change

It is useful to present both the 1994-Curriculum and the 2004-Curriculum, since both were in use at the time I conducted the research project in the 2004/2005 academic year at junior secondary level.

Almost every ten years, the school curriculum in many countries is reviewed. In Japan, for example, the school curriculum was reviewed in 1967, 1976, 1987, and 1998 (Shizumi, 2000, p. 116; Nobuhiko, Shizumi, Kohzoh, & Kazuhiko, 2000). In Indonesia, within three decades, the school curriculum has been modified four times: in 1975, 1984, 1994, and in 2004 (Turmudi, 1986; Departemen Pendidikan dan Kebudayaan, 1993; Departemen Pendidikan Nasional, 2004). Changing the school curriculum has a wider impact on the existing school systems. The infrastructure should adapt to the new situation, new teaching strategies should be introduced to the teachers, and other facilities should be provided by government. In other words, the government should anticipate possible problems that emerge as an effect of the curriculum changes.

Currently, the school curriculum mandated in Indonesia is in transition. In 1994, the 1994-Curriculum Structures for junior secondary schools were introduced. It was based on the Education and Culture Minister Decree of RI (SK Mentri Pendidikan dan Kebudayaan Nomor 060/U/1993, dated February 25, 1993). Mathematics lessons for junior secondary level were allocated six periods per week, indicating that mathematics plays an important role in education, since many other subjects were allocated fewer than six periods per week For example, science subjects such as physics and biology were together allocated six periods per

1 The low achievement of students is not only in mathematics but also in other subjects, such as Bahasa Indonesia (Indonesian Language), English, and Sciences (Dinas Pendidikan Nasional-Jabar, 2004).

week, and geography, economics and history subjects were together allocated six periods per week (see Table 1.2).

Table 1.2 Program structure for primary and junior secondary schools (Sekolah Dasar (SD) and Sekolah Menengah Pertama (SMP))

No.	Subjects	Primary School						Junior Secondary School		
	Grade(s) –Year Level	I	II	III	IV	V	VI	I	II	III
1.	Pancasila [2] and Citizenship	2	2	2	2	2	2	2	2	2
2.	Religion Education	2	2	2	2	2	2	2	2	2
3.	Indonesian Language	10	10	10	8	8	8	6	6	6
4.	Mathematics	10	10	10	8	8	8	6	6	6
5.	Natural Sciences	-	-	3	6	6	6	6	6	6
6.	Social Studies	-	-	3	5	5	5	6	6	6
7.	Craft and Art	2	2	2	2	2	2	2	2	2
8.	Physical Education and Health	2	2	2	2	2	2	2	2	2
9.	English	-	-	-	-	-	-	4	4	4
10.	Local Content	2	2	4	5	7	7	5	5	5
	Total	30	30	38	40	42	42	42	42	42

Note: Time duration for one period lesson

1) Grade I and II of Primary School: 1 period lesson = 30 minutes
2) Grade III to VI of Primary School: 1 period lesson = 40 minutes
3) Grade I to III of Junior Secondary School: 1 period lesson = 45 minutes

Source: Hinduan, Hidayat, & Firman (1995)

The goals of learning mathematics in junior secondary education, according to the National Curriculum of 1994, were:

- to prepare students to survive as citizens in their lives and in the world by acting logically, rationally, critically, accurately, fairly, effectively, and efficiently;
- to prepare students to use mathematics and think mathematically in the academic world and in the world at large (Departemen Pendidikan dan Kebudayaan, 1994).

2 Pancasila: five principles of the state's philosophy: (1) belief in one God; (2) just and civilized humanity, including tolerance to all people; (3) unity of Indonesia; (4) democracy led by wisdom of deliberation among representative of the people; and (5) social justice for all (Mugiadi and Jiyono, 1994)

A decade after the introduction of the 1994 school curriculum, a new curriculum document was introduced. This curriculum, known as the "competence-based curriculum" (*Kurikulum Berbasis Kompetensi*, KBK) emphasizes the students' competence.

Objectives of mathematics teaching at junior secondary level based on the 2004-Curriculum are to improve students' capabilities in several aspects (Departemen Pendidikan Nasional, 2003)

- **Understanding** of mathematical concepts. Students are able to define and identify the concepts, to give examples and contra-examples of the concepts.
- **Mathematical reasoning.** Students are able to perform inductive and deductive reasoning.
- **Problem solving**. Students are able to make mathematical models of a problem, apply solution strategies, and interpret the results of the solution.
- **Mathematical communication**. The students are able to state and interpret mathematical ideas orally or in written communication or demonstrate it.
- **Procedure.** Students are able to recognize procedures and correct or incorrect calculation processes.

Comparison of the goals of the two curriculum documents show that the 2004-Curriculum Documents give more emphasis on specific abilities such as mathematical understanding, mathematical reasoning, problem solving, communication, and procedural mathematics (Departemen Pendidikan Nasional, 2004). These aims are similar to those expressed in documents produced by the United States' National Council of Teachers of Mathematics (NCTM, 1989, 2000) and the Australian Education Council (AEC, 1991). In fact the mathematics education reform agenda in Indonesia is commonly adapted from other developed countries: USA (NCTM, 1989, 1991, 2000), Australia (AEC, 1991), Japan (Becker & Shimada, 1997), The Netherlands (Goffree & Dolk, 1995), Britain (Cockcroft, 1982; Westwell, 2005) and other European countries.

In the 2004/2005 academic year, the 1994-Curriculum document was still used by the Year-8 and Year-9 students (at junior secondary level), and the 2004-Curriculum document was used by the Year-7 students. One year later, in the 2005/2006 academic year, the 1994-Curriculum was still used by the Year-9 only, and the 2004-Curriculum was used by the Year-7 and Year-8 students. Overall, the implementation steps of curriculum in transition can be seen in the Table 1.3.

The academic year in the Indonesian school system begins in July every year. According to the framework of the 2004-Curriculum document, in 2006/2007, the new curriculum would be in use at every school.

Table 1.3 Planning for Implementation of the 2004-Curriculum

School	Primary School						Junior			Senior Secondary		
Years	1	2	3	4	5	6	7	8	9	10	11	12
2004/2005	V			V			V			V		
2005/2006	V	V		V	V		V	V		V	V	
2006/2007	V	V	V	V	V	V	V	V	V	V	V	V

V = implementation of the 2004-Curriculum **Source: Departemen Pendidikan Nasional (2003)**

Even though the goals of both curricula differ, the strands of mathematics in junior secondary school remain the same, except for one strand trigonometry. These comprise arithmetic, algebra, geometry, trigonometry, chance, and statistics (Departemen Pendidikan dan Kebudayaan, 1994) whereas the strand of 2004-curriculum are numbers, algebra, geometry and measurement, and chance and statistics (Departemen Pendidikan Nasional, 2004).

1.6 Indonesia follows international curriculum change

Innovations in mathematics education in Indonesia constitute an integral part of its educational system. Some innovations which particularly focus on the teaching and learning of mathematics can be used as models, for example, the perspectives of Wood and Berry (2003), Romberg (1992), De Lange (2000), Gravemeijer (2000a), Miller and Hunt (1994), Lewis (2000) and Stein, Silver, and Smith (1998). Learning and teaching strategies of mathematics which challenge students to learn mathematics need to be tested and monitored to yield the best and the most effective ways to learn and teach mathematics. This can be done by using “design research” (Wood & Berry, 2003), “development of new instructional techniques or program” (Romberg, 1992), “developmental research”(De Lange, 2000; Gravemeijer, 2000a), “collaborative learning experience in action research” (Miller & Hunt, 1994), “Japanese Lesson Studies” (Lewis, 2000), or “reflective practice groups and communities of practice” (Stein et al., 1998).

All these types of innovation are guided by the strategies advocated by Curriculum and Evaluation Standards for school mathematics (NCTM, 1989), Professional Standard for Teaching Mathematics (NCTM, 1991), Assessment Standards for School Mathematics (NCTM, 1995), Open-Ended Approaches (Becker & Shimada, 1997), Australian Statement for School Mathematics (AEC, 1991), and the Netherlands’ experts in mathematics education (Goffree & Dolk, 1995).

According to Zamroni (2000), Indonesian education orientation has traditionally been characterized by several points, namely, a tendency to treat students as objects, put the teachers as the highest authority holder, present courses as subject-oriented, and place management as centralized. As a consequence, educational practice is isolated from real life, with no relevance between what is taught and what is needed in the market place; and it needs

a stronger focus on the intellectual development of the students. In contrast, the new paradigm of education focuses on learning rather than teaching, education is organized in a more flexible structure, the learners are treated as individuals with certain characteristics, and education is a continuous process and interacts with environment (Zamroni, 2000).

Introducing a new teaching approach requires research to monitor and validate it. Regarding mathematical competence as an instructional goal, there is a common agreement that the final goal of student learning is the acquisition of a mathematical disposition rather than an accumulation of isolated concepts and skills. Accordingly, the way students acquire mathematical knowledge and skills should be re-organized. It must involve students in active learning (Verschaffel & De Corte, 1996)

The international trend noted above leads to many new approaches to the teaching and learning of mathematics, such as realistic mathematics (De Lange, 1996), contextual learning (Hirsh, 1996), open-ended approaches (Becker & Shimada, 1997), and problem solving (Silver, 1989; NCTM, 2000).

This study takes as its central focus the realistic mathematics approach to education (RME). RME is a teaching and learning approach to mathematics based on problems taken from day-to-day experience rather than on abstract rules (De Lange, 2000). Furthermore, De Lange (2000) stated "RME incorporates views of what mathematics is, how students learn it, and how it should be taught" (p.4).

This approach is used in this thesis to develop and monitor learning materials incorporating RME for junior secondary schools in Indonesia.

1.7 International collaboration: innovation programs in Indonesia since 1979

To give an overview of the innovation movement in education in general and mathematics education in particular, Table 1.4 presents a summary of innovation projects introduced in Indonesia in recent years.

Table 1.4 Brief summary of projects and programs in Indonesia, over the last three decades

Project/ Program	Year	Brief Description about the project/Program	Results
SPP/CBSA or Professional Support and Student Active Learning, in Cianjur West Java, 1979 – 1984	1979-1984	Aim: To support primary school teachers to be professional. A kind of action research with objectives to examine the extent to which classroom would change if teachers were given more professional support by headmasters or supervisors. (Aarons, 1989).	The try-out session was successful, with varying degrees of success and understanding. Included: the use of group work to undertake surveys, experiment and conduct investigation; the presentation of information through dramatization, reporting, model-making, and graph; and the use of local environment as learning resource in social studies, sciences, and language. Public enthusiasm for CBSA was high, leading to a replication to a wider context (dissemination). However, at the dissemination stage, this project was unsuccessful (Joni, 1993; Semiawan & Joni, 1993).
JICA-Project Joint cooperation between Japan Experts and Indonesian Educators in UPI, UNY, and UM	1997-2007	Joint cooperation between JICA (Japan International Cooperation Agency) and Indonesian Universities (UPI, UNY, and UM) called JICA-IMSTEP (JICA – Improvement of Mathematics and Sciences Teaching for Primary and Secondary Education in Indonesia). Aim: to improve the quality of mathematics and science in junior and senior secondary levels, as well as primary school level. The development of the project related to four main projects: Development of students' materials, development of strategies and teaching methods, development of teaching and learning media, and development of assessment. In the period of 2002-2004 the Pilot Project of the teaching in mathematics and science were conducted in Junior and Senior Secondary schools. These approaches are similar to the Lesson Study (Hendayana, 2003, Lewis, 2000).	Awareness of the teachers toward mathematics and science innovation was improved. Some findings suggested that teachers were motivated to always give opportunity to learners to play wider roles in their learning in the classroom. In mathematics lessons, for example, providing opportunity for learners to observe and to make, test and prove mathematical conjectures would increase their self-confident to learn more about mathematics.
Contextual Teaching and Learning Project on Science, Mathematics, Social Studies, and English	2002-2003	Originally developed in Surabaya (Umaedi, 2002) This project focused on the development of students' textbooks of science, mathematics, English, and social studies using contextual framework.[but not based on the Realistic Mathematics Theory]. (Nur, 2001; Nur, 2002; Umaedi, 2002; Ismail, 2002).	Still in progress. However, the dissemination project had been developed in a wider context of schooling all over Indonesia. Note: 'Contextual' in this program/project was not the contextual learning based on the RME approach.

2004-Competence-Based Curriculum for all levels of schooling from Primary to Senior Secondary Schools.	2002-2004	Introducing the 2004-Competence Based Curriculum, which emphasizes the students' competence rather than the subject matter. The try-out of the projects was implemented on a limited scale in a number of schools (and province level). This was a TOP-DOWN project which hopefully would be implemented at the national level. (Siskandar, 2001, 2003; Hayat, 2003).	Results of the program indicated that a number of problems related to the introduction stages of the curriculum remained. This was still less operational examples how to run the Competence Based Curriculum Program in the classroom. Some teachers in the current study admitted that the RME approaches were relevant to the KBK (Competence Base Curriculum Program).
Pendidikan Matematika Realistik Indonesia (PMRI or Realistic Mathematics Education in Primaty School). Joint Cooperation project between Dutch Experts and Indonesian Educators (UPI, UNY, UNESA, and ITB).	2002-2007	The realistic mathematics teaching approaches in primary school level were introduced in 2002. 12 primary schools were involved in the initial project (3 in Bandung, 3 in Yogyakarta, and 3 in Surabaya). This project is more of a BOTTOM-UP project; to find the best strategies and the most effective way of teaching mathematics. (Zulkardi, 2003; Sembiring 2003; Furqon, 2004 and Van Velzen, 2004, Pendidikan Matematika Realistik Indonesia, 2004; Pendidikan Matematika Realistik Indonesia, 2005).	The results of the project indicated that this teaching approach was positively accepted by the students as well as by the teachers. This approach improved the teachers' self-confidence to teach mathematics, improve a democratic attitude for the students. The teachers changed to be better helpers, to be more student-centered. The teachers were more aware of mastering classroom management, collaborative work, learning process, and a constructivist perspective. The temporary results of the project were promising.
Small project of the RME at junior secondary level in Bandung	2001-2003	Sub-sequential small-scale research in implementing the RME approach at junior secondary level in Bandung, emphasizing students' reactions and the attitudes toward mathematics teaching approaches based on the RME theory. (Turmudi, 2001; Turmudi and Dasari, 2001; Turmudi and Sabandar, 2002; Turmudi, 2003).	Data from these small-scale case studies of classroom observations and interviews with students indicated a tendency towards an improvement in students' attitudes toward mathematics. However, a wider research context and a more carefully designed study are needed to establish whether the RME approach can improve students' achievement in mathematics as well as improve their attitude toward mathematics.

Under ideal conditions, the SPP/CBSA projects were effective in changing how to teach subjects (mathematics, sciences, social studies, languages) (Aarons, 1989), but when these approaches were disseminated in a wider context they were unsuccessful (Semiawan & Joni , 1993)

The JICA-IMSTEP project is a long term project to be implemented eventually at the national level. The university that was involved in it was described as "Growth-Centered" (Shimozawa, 1995). This project focused on the improvement at all school levels through the improvement of teaching strategies in teacher training colleges. This project is still taking place in Bandung (West Java), Yogyakarta (Daerah Istimewa Yogyakarta) and Malang (East Java). Most of the activities in the JICA-IMSTEP project during 2003-2006 were pilot studies or what in the Japanese tradition is called Lesson Study (Lewis, 2000), a try-out of mathematics and sciences teaching strategies in

junior as well as senior secondary schools. The results of the project indicate that the teachers involved in the studies have improved their awareness of the new approaches. There are other promising results, but these are not specifically in mathematics.

Contextual Teaching and Learning in Sciences, Mathematics, English, and Social Studies projects were developed in Surabaya (Umaedi, 2002). Mathematics in this framework was not based on the RME theories. This project emphasized the development of students' materials (books) for many subjects. Though this project has not shown optimal results, this project seems applicable to a wider context.

PMRI was introduced in 2002. The 10-year project, which deals with the innovation of primary mathematics instruction based on the realistic perspective, is now conducted in the three different cities, Bandung, Yogyakarta, and Surabaya (Pendidikan Matematika Realistik Indonesia, 2004; Pendidikan Matematika Realistik Indonesia, 2005). The results of the project indicate that this teaching approach is being positively accepted by both students and teachers. It is improving teachers' confidence to teach mathematics and developing students' democratic attitudes. The teaching is becoming student-centered, and the teachers are becoming better helpers, more aware of classroom management, collaborative work, learning processes, and constructivist perspectives. The early results of the project are promising (Zulkardi, 2003, Furqon, 2004).

Several small studies were conducted to investigate the effect of the realistic mathematics teaching approach on the students' attitude toward mathematics. These were case studies, with data gathered by interviewing and observing the learners and teachers in the classroom. The results indicated that the students were motivated to learn more about mathematics, and the students also responded to the teaching strategies used by the teachers. All these small studies used trainee students as teachers (Turmudi, 2001; Turmudi & Dasari, 2001; Turmudi & Sabandar, 2002).

The SPP/CBSA model positively influenced teachers to change from the teacher-centered to the student-centered approach. The JICA-IMSTEP Lesson Study model seemed to have a positive impact on the growth of awareness to adopt an innovation in mathematics and sciences.

The development of realistic mathematics education (RME) at primary school level has also indicated positive results, such as improving the teachers' self-confidence, developing students' democratic attitudes, and changing the way of teaching towards becoming more of a helper.

The RME project was conducted at primary school level. I was interested in replicating these findings at junior secondary level. The findings motivated me as a researcher to examine whether a professional development program on the RME teaching approach has a positive impact on junior secondary students' achievements and attitudes toward mathematics. Consequently, small-scale studies on RME teaching approaches were conducted at junior secondary level, and the results were promising. The participants in these studies were students at a teacher training college. The findings indicated positive impacts on the trainee teachers' attitudes toward mathematics and mathematics instruction.

1.8 The current research and thesis

A schoolteacher of mathematics collaborated in the junior secondary level studies described above, but the RME approach has not yet been introduced in Indonesia using mathematics teachers at a school. Finding out what happens in this wider context is the purpose of my current research. The study described in this thesis focuses on examining the effect of the RME teaching approach, as implemented by trained teachers, on students' achievements in and attitudes toward mathematics in junior secondary schools in Indonesia.

Chapter 2 reviews the relevant literature. Chapter 3 describes the research methodology and methods. Chapter 4 describes the pilot study. Chapter 5 presents the results of the main study. Chapter 6 gives the conclusion and recommendations.

Chapter 3 Pilot Study

Chapter 4 Main Study Methodology and Methods

Chapter 5 Results and Discussion

Chapter 6 Conclusion and Recommendations

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