DEVELOPING MATHEMATICS EDUCATION IN INDONESIA

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I. INTRODUCTION

Raising the intellectual level of the people and furthering general welfare as mandated in the Preamble of the 1945 Constitution have always been major concerns of the Government of Indonesia. The aims of the education system include : (a) enhancing full devotion to God Almighty; (b) developing the intelligence and skills of individuals; (c) fostering positive attitudes of self reliance and development, (d) ensuring that all children are literate. The Board Outline of State Policy lays down the need of continuation of national education to be redefined, developed, and strengthened by providing it with the necessary legislations. This gives priorities to expand the opportunities and improvement of the quality of basic education, vocational-technical education and to implement the extension of compulsory basic education form 6 to 9 year. Accordingly, since the year 1993, the themes of educational development are equity and expansion, improvement the quality, improvement of relevance and efficiency.

Since 1968/1969, a more systematic approach to develop education in Indonesia has begun to be evident. Since that time up to the late of 1990, the approach to develop education has designed under the assumption that curricular objectives could be logically derived from national and system-wide goals and then broken down into a precise hierarchy of instructional objectives, and that learning could be made individualized and 'teacher-proof' so that students could learn what they needed to learn with minimal assistance from teachers (Shaeffer, 1990, pp.22). However, in 1984, evidences indicated that the approach was perceived not to able to mobilize resources and to embark the model to the nationwide application.

The current picture of teaching practice in Indonesia is generally extensive teacher directed explaining and questioning in the context of whole class instruction followed by students working on paper and pencil assignments at their places. The teacher functions as the central figure in determining activities and conducting instruction; and, the students rarely actively engage in learning directly from one another or in initiating processes of interaction with others. Most teachers observed spend most of the time conveying information to children; the blackboard is by far the commonest visual aid but was often used as the teachers' scribbling pad rather than for presentation of a logical sequence of ideas. The challenge for educators in the next decade is to improve students' learning of higher order skills in mathematics; teachers should organize instruction to involve children so that they actively construct their own knowledge with understanding (Peterson in Grouws, et al., 1988).

It seems that the unsuccessful of the project for promoting educational change in Indonesia due to the constraints such as : (1) the complexity of the educational environment, (2) the limitation of the

budget, (3) lack of educational resources and facilities, (4) the divergences of the educational context such as ethnicity, geography, culture and value, (5) lack of teachers' understanding of the theories of good practice of teaching and how to implement it, and (6) the mediocrity of developing education based on the nature of the fundamental sciences and education, and or based on the need for competing skill in global era.

II. DEVELOPING MATHEMATICS AND SCIENCES EDUCATION IN INDONESIA

A. Current Picture Of Mathematics And Science Education In Indonesia

The currently studies on mathematics and sciences education in Indonesia have the indication that children's achievement in the subjects of mathematics and Science is low, as indicated by the result of the National Leaving Examination (EBTANAS) year by year both in Primary and Secondary School. Children's mastery on Mathematics and Science concepts and Science process skills is still low. This fact may be as the results of: (a) the shortage of laboratory activities; (b) lack of teachers having mastered science process skill approach; (c) contents on Mathematics and Science curriculum too crowded; (d) too many time consuming administration stipulation for teachers; (e) lack of laboratory equipment and laboratory human resource. The studies also indicates that mismatch among the objectives education, curriculum, and evaluation system which can be identified by the following: (a) National Leaving Examination assess the children's ability cognitively only; (b) Streaming in Senior Secondary School starting at grade 3. It is argued that the implementation of this system is late and consider individual differences inappropriately; (c) University Entrance Examination (UMPTN) System is considered to trigger Elementary and Secondary School teachers apply goal oriented rather than process oriented in teaching Mathematics and Science.

In preparing Primary and Secondary School teachers, we face problems such as those who enroll (input) to LPTK have low potential academically and many private LPTK with low quality also produce Mathematics and Science. In-service teacher training system for Mathematics and Science teacher is not organized integrated and systematically, in terms of both the content and the management. In terms of Mathematics and Science teachers in School, it is found that: (a) their qualification need to be improved, (b) many of them are not major in Mathematics and Science, (b) there is no evaluation system (academically) for teachers, so once to be a teacher, they will be a teacher until the age of retired. In the schools, monitoring system, it is considered that: (a) supervisor (pengawas) and principle monitor the teachers administratively only. They do not or seldom monitor the teaching process in classroom, (b) promotion system for teachers do not support the improvement of teachers' competency.

In the area of curriculum, it is found that: (a) many teachers still have difficulty in analyzing the content of guidelines for teaching program (GBPP), (b) a number of Mathematics and Science topics are considered to be difficult for teachers to teach; (c) a significant number of children consider some Mathematics and Science topics as difficult to understand, (d) teachers consider that the sequence of some topics need to be re-arranged, (e) science teachers consider that mathematical aspects in science need to be simplified; (f) teachers consider that they need guidelines for conducting teaching process by

using science process skills approach.

In the area of teaching approach, it is found that: (a) teachers in Elementary and Secondary School have not mastered "science process skills approach" for teaching Mathematics and Science; (b) most teachers use conventional approach in teaching Mathematics and Science, (c) it is very rare teachers use hands on and practical work activities; (d) a favorite senior secondary school drill the children at grade as preparation for taking university entrance examination; (e) most teachers want to get a training containing of innovative teaching approach. In the area of learning facilities and textbooks, it is found that : (a) many teachers do not use package books as compulsory book for children; (b) most teachers use Mathematics and Science Books produced by a certain publisher considered to be "good"; (c) exercise books are preferred by most teacher and children; (d) children do not like package books as the books are not straight forward.

In the area of assessment, it is found that most teachers: (a) use objective tests in assessing children's achievement in Mathematics and Science; (b) seldom use essay tests in assessing children's achievement in Mathematics and Science; (c) assess the children on the aspect of cognitive only; (d) still lack of knowledge and skills in assessing science process skills of the children; (e) do not have appropriate knowledge of portfolio as a method of assessment; and (f) want to get a training containing of up to date method of assessment.

B. Improving Mathematics and Science Education: International Cooperation

The JICA Technical Cooperation Project for Development of Teaching Science and Mathematics Education in Indonesia (IMSTEP) has been working since October 1, 1998. For the first-four years there have been lots of activities done in three universities (Indonesia University of Education-UPI, State University of Yogyakarta-UNY and State University of Malang-UM). These activities were mostly done to strengthen the pre-and in-service teacher training programs. It was expected that some of JICA IMSTEP activities be conducted to improve practice at schools. Two of activities included in the revised Project Design Matrix are "to conduct piloting for improving mathematics and science education in primary/secondary schools" (Act 1-19) and "to exchange experience on curriculum and its implementation with schools and pre- and in-service teacher training institutions". (Act 1-20). These two activities were added to accommodate the expectation of the Directorate General of Primary and Secondary Education that the outcomes of the project should have direct effect to schools.

Piloting is defined to the activity of developing and trying out some teaching models at schools. The lecturers and teachers worked collaboratively at schools to develop the teaching models needed at field. Basic Strategy for piloting was promoting the new paradigm of mathematics and science education.

The objectives of piloting is to contribute to the improvement of mathematics and science education in schools by trying out some matters developed in this project which are directly related to schools. The piloting activities were done through collaborative classrooms action researches among lecturers and teachers. Each group of researchers met to discuss what to improve and how to improve the mathematics and science education in each of the classrooms. Those aspects to be improved were varied according to

the perceived needs of the junior and senior high school teachers. Those aspects could be related to the development of instrument and equipment of teaching methods and model for teaching of teaching materials, of teaching evaluation for teaching and learning processes. Mostly there were improvements in teaching learning practice of mathematics, physics, chemistry, and biology.

The results of piloting could be mentioned from the point of view of students, teachers, and of lecturers. Most of students in each class were enthusiastic in learning using the new media, methods, or approaches Students' motivation to learn mathematics and sciences were also improved. These can be seen for example from the response given by students in West Java collected through questionnaire. There were more activities done by students in science laboratories, especially activities to improve their process skills. There were also increases in students' performance. One of the junior high school physics teacher in West Java mentioned that the mean score for waves unit improve from 6.7 to 7.9 Through piloting many teachers were introduced some innovations in mathematics and science teaching and learning.

The new model introduced to teachers increase the variation of alternatives of how to conduct classroom teaching and learning process. Now they have more choice to teach certain units of studies. Teachers involved in these piloting activities developed their competencies in teaching mathematics and science. The competencies developed for teachers in every area are as follows: realistic approaches (RME), authentic assessment, and constructivist approach in teaching mathematics teaching.

Teachers involved in these piloting activities have to think and develop new ways of how to let students learn and construct their own concepts. Therefore, their creativity was improved. Teachers had to be patient to start to more from "teacher centered paradigm" to "students centered paradigm". In order to stimulate students to think, teachers has to ask questions. By doing these, there questioning skills were improved. Through piloting activities lecturers were also benefited in knowing more about the problems faced by teachers and schools in conducting mathematics and science teaching and learning.

There are some issues and problems relating to introducing the new paradigm of mathematics and science teaching and learning through piloting activities. It seems not realistic to hope that teacher style of teaching changes drastically in a short-term program. The crowed curriculum and the large number of students make the teachers keep their "teacher centered activities". Pilot teachers need long-term programs to en-culture their innovation of teaching. National final examination, which has to be taken by all students in the third year, becomes the very crucial point for the teachers due to the fact that mathematics and science teachings are usually designed based on it. It implies that teachers tend to conduct "teacher centered" and "product oriented" classroom to achieve these goals. They perceived that new approaches of teaching, which based on students' thinking processes skills, takes more time to develop plan so that some teachers prefer to teach traditionally.

The results of piloting activities come to a suggestion that to improve mathematics and science teaching in Indonesia, we need to : (1) implement more suitable curriculum i.e. more simple and flexible, (2) redefine the role of the teachers i.e. teachers should facilitate students' need to learn, (3) redefine of the role of principals; principals should support the professional development of teachers by allowing them attend and participate in scientific meetings and trainings, (4) redefine the role of schools; schools should promote school-based management, (5) redefine the role of supervisor; the supervisors

need to have similar background with the teachers they supervise in order to be able to do academic supervision, (6) improved autonomy of teachers in trying to implement innovations in mathematics and science teaching and learning, and (7) promote better collaboration between school and university; communication among the lecturers and the teachers should be improved; these could be done through collaborative action researches and exchange experiences through seminars and workshops.

C. THE LATEST ACTION : Competent-Based Curriculum/Curriculum 2004

Indonesia Government strive to boot-strapping the latest issues of education and take an action to implement the new curriculum "competent-based curriculum" for primary and secondary education that effectively starts in the academic year 2004/2005. This policy will logically imply to some of the following aspects: educational autonomy program, developing the syllabi, improving teachers competencies, learning facilities, educational budgeting, empowering the society, evaluation system and quality assurance. At any socialization of this new curriculum, there was always a program to elaborate the rational, philosophical background, and method for developing the syllabi.

Following is the difference between Curriculum 1994 and Curriculum 2004

Aspect	Curriculum 1994	Curriculum2004
Content	National 80% Local Content 20%	National 20% Local Content 80%
Approach	Content-based	Competent-based
Model for Sosialization	Trying-out	Piloting

The results of the monitoring of piloting the new curriculum in some provinces indicate that the constraints are still coming from the immanent problems: teachers' motivation and competencies as well as un-supporting educational management system.

III. Conclusion

Cooperation among educational institutions such as looking for alternative models in reference to educational experiences from some other countries may get some benefits the chances to: (a) discuss and improve the implementation of curriculum covering development of text-books, teaching materials, teaching methodologies, and assessment, (b) enrich the experiences of mathematics and science educators, (c) improve teaching learning quality and developing laboratories, (d) solve the mathematics and science teaching learning problems at schools, (e) recommend the ways of improving mathematics and science education, and (f) meet the society expectation of what is called good practice of mathematics and science education.

For the exchange experience activities among educational institutions it may varies such as: (a) conducting seminars and workshops, (b) conducting joint research activities, (c) publishing and

disseminating the results of exchange experiences and or journals, (d) establishing network among institution or countries. The good point of the Japanese education that can be the references covers: (a) the average of teacher's ability and the quality of the class is comparatively high, (b) precise class design, teaching, (c) an education environment, education condition and so on is homogeneous as to the whole country, (d) teachers are diligent, (e) equality principle, (f) teacher's sense of responsibility is strong, (g) teacher's treatment is comparatively good, and (h) public school teachers must move to other school in some years.

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