

“ Looking for Alternative Models in reference to Japanese Educational Experiences “

**MATH PROGRAMS
FOR INTERNATIONAL COOPERATION 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 from 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. Piloting Activities Of Teaching Learning Mathematics And Sciences In Indonesia Supported by Imstep-Jica Project

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 move from "teacher centered paradigm" to "students centered paradigm". In order to stimulate students to think, teachers has to ask questions. By doing these, their 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 crowded 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.

III. LOOKING FOR ALTERNATIVE MODELS IN REFERENCE TO JAPANESE EDUCATIONAL EXPERIENCES

A. Current Picture Of Mathematics And Science Education In Japan

The purpose of mathematics education in Japan is to study how to think, the point of view of every thing, and better human being formation through learning of mathematics; to study mathematical practical use, utility through learning of mathematics; and to enjoy and develop the wonderful cultural heritage of mathematics through learning of mathematics (Nishitani, 2002). Further he stated that the characteristics of the new course of study in Japan consist of: (a) reduction of the learning contents, (b) decrease of the number of classes, (c) comprehensive five-day school week, (d) integrated study mathematical activities, (e) practical and operational activities and problem-solving activities and so on, (e) basis points of active learning, (f) have the purpose of learning clearly, (g) have interest in the subject, (h) have an perspective to solve the problem, (i) have a feeling of satisfaction and joy, and (j) acquire the way of learning

Based on the observation of teaching practice and school visits in Japan (Marsigit, 2000), the writer has some conclusions that the present education system in Japan is striving to perform of lifelong learning in which it foster basic skills and abilities. Various learning opportunities are to be provided and the educational reforms is to be held by examining and implementing the revised curriculum directed centrally by the Ministry of Education. The government of Japan strives to establish the lifelong educational system in cooperation with schools, industries, NGOs, and other institutions. Nine years of compulsory schooling consists of 6 years of primary school and 3 years of junior secondary school.

The Japanese educational system is characterized as centralized in which at the regional level, the prefectures or district has its own board of education. The schools are established by the national government, a local government or an educational cooperation. The board of education carries out the educational functions of the local government. Teachers are encouraged to be more flexible and to recognize that children need to be active. Teachers encourage their students involving in classical discussion. It seems that teachers more emphasize on teaching with understanding than stressing on calculating. However, some teachers implement a series of drills to master the skills.

The students in primary and secondary schools are to be given textbooks freely from the government. The Ministry of Education has the authority to decide the textbooks to be used in the schools and decide the publisher to procure them. The Mombusho set up the committee consisting of university professors and teachers to ensure that the textbooks meet the standards of National Curriculum. There are three levels of textbooks in senior high schools: difficult, medium and easy; while in primary and junior there is only one level. The students' text-books are completed by teachers' manuals.

Some of the students by their own initiations, complete the books by buying from the bookstores. The teachers use the textbooks for developing their mathematics problems. The students are instructed to

bring the textbook to their home. At class, the students use both textbooks and book of collection of problems. Calculators are to be used but only a little; some of the teachers perceive that calculator has a little value in education. However, teachers introduce abacus for laying the basic skill of computation. Most of primary schools employ worksheets in their teaching.

Teachers implement two methods to assess students' academic achievement that are examination and observing their activities. The teachers encourage their students to have the correct answer. The teachers pay more attention to their students who have wrong answer. The teachers implement regular tests about once a month. Teachers use the results of the tests to define students' differences in academic ability. Teachers use the results of the test for monitoring the level of academic achievements. The higher level of school uses the results of examination to rank the incoming students to their schools. The leaving examination are prepared by the regional board of education; the board then uses the results of examination to compare the quality of schools entire the district. While the entrance examination to University, the senior high schools graduate students are able to take tests at the Center of Examination. Japanese government coordinate local and regional school board and involve the teacher in revising the curriculum. Teaching practice in schools should directly link to that curriculum follow the reform promoted by the government. The schema of teaching styles developed by the teachers seems predominantly based on problem solving. In problem solving, teachers strive to encourage whole class discussion on which sometime the teachers probes the students' works at their table. In elementary school, teachers seem to develop activities involving concrete operation using concrete material to help the students to internalize mathematical concepts.

Japanese educationists encourage the teachers to develop evaluation system based on the way of mathematical thinking and interest in and attitude towards mathematics. Team teaching is now a new trend; teachers and experts pay much discussion on developing teaching method. Japanese educationist has been en-culturing the way to improve teaching learning processes through "class research" in which a certain teacher perform his/her developed methods of teaching to be observed by other teachers. After finishing such kind of this activity they discuss and seminar of the aspects of teaching. The schools are well cooperatively with the universities in promoting better mathematics and sciences teaching.

The significant confidences make by the U.S National Commission on the current situation of teaching practice in Japan (Glenn, J, 2000). The report stated that teaching learning of mathematics in Japan are closely supervised, collaborative work among students is the norm. Teachers begin to present their students with a mathematics problem employing principles they have not yet learned. They then work alone or in small groups to devise a solution. After a few minutes, students are called on to present their answers; the whole class works through the problems and solutions, uncovering the related mathematical concepts and reasoning. Further, the students learn through reasoned discovery, not lecture alone. Not incidentally, this approach is a natural outgrowth of the teaching culture in Japan, which accords teachers not only abundant time for preparation, but also for collaborative lesson planning. Fully 99% of all elementary teachers and 50% of all middle school teachers participate in lesson study groups that meet for two to five hours per week.

B. Japanese Mathematics and Sciences Educational Development as an Alternative Model

The Japanese mathematical movement swung between the sides of the movement of the education which has an idea from the real phenomena and life (real cultivation). The movement which has an idea from the mathematical system itself. After the Second World War, Japanese government introduced official approval system of textbook. Several textbook companies publish the text-books which passed the censorship of the ministry of education, culture. Each administration district selects the textbook. Each society hold annual meeting, in which many scholars and school teachers present own papers and discuss together. These academic activities are very important to improve Japanese mathematical education. In the teacher license system, there are three kind of license i.e. the first kind license, the second kind license and higher kind license. Teacher license is lifelong, not renewal system. Each prefecture do the examination of teacher employment once a year. Because of the decrease of number of children, the number of new teacher employment is also decreasing.

Each school does many kinds of activities to improve teachers' teaching skill (Nishitani, 2002), as followings are: (a) some schools introduce several classes to the public; many teachers of other schools visit the school to watch classes and discuss, (b) every elementary school has research class, in which some teachers show their class to other staffs; after class all staffs discuss about the class, (c) every school introduce all classes to the public a few times in a year; many parents visit school to watch their child's



Figure 1: Observation of mathematics teaching learning processes

state in class, (d) there are many opportunities for teachers to attend training courses which are provided by prefecture education board and universities. While the strategies developed by the teachers covers: (a) learning basics concepts, (b) grasping the problem (motivation), (c) expectations (perspective), (d) solving the problems, (e) summarizing the learning contents, and (f) applying the learning contents.

Based on the school observation activities of the practice of teaching learning mathematics and sciences in Japan (Marsigit, 2000), there is a special consideration “research class” activities. In such

kind

of activities, a group of teachers of a certain subject-matter, plan an activity for “observing” teaching learning mathematics or science of a certain teacher. The observer can be his or her colleagues, teachers from other schools or even some time they invite professor from universities. In turn to the teacher, professor from universities have a chance to perform his/her skill to teach mathematics or science. Finishing observation of the practice of teaching, they have had a discussion and seminar. It seems that Japanese teachers have a culture to implement these kinds of activities to socialize their findings of “research?”; therefore, in my point of view, this can be a good model for other countries to do the same with them. Amazingly, they carry out this program voluntary and self-funding. In Japan



Figure 2 : Professor Shizumi Shimizu of Tsukuba University was practicing teaching learning mathematics process at Primary School

many kind of teachers’ activities in schools and universities which we observed, make good effects in Japanese mathematical education.

To improve the quality of mathematics and sciences education, in a certain occasion, Japanese educational expert suggested the followings: (a) implementing open class teaching, (b) encouraging the teachers to make their own teaching material (textbook), (c) evaluating teaching learning processes by their students, (d) analyzing students’ mistakes and errors, (e) encouraging the teachers to have good and strong will (spirit) to develop their competences, (f) implementing good balance of old and new method in teaching, (g) promoting good collaboration between university and school, (h) teachers should have their own original method in teaching, (i) teachers should continue to develop their teaching ability, (j) teachers always ask how to make their own class better, and (k) the role of teacher is similar to doctor; rescue the children.

VI. Conclusion

Cooperation among educational institutions such as looking for alternative models in reference to Japanese educational experiences 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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