

HELPING TEACHER TO DEVELOP MODEL FOR SECONDARY MATHEMATICS TEACHING: Action Research of Indonesian Secondary Mathematics Teaching

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Abstract : Preliminary research of a high-schools teacher indicated that teachers styles of teaching was dominantly by “exposition method” i.e formal-classical-teaching in a cycle of explaining the concepts, giving the examples, delivering the questions and giving the assignments. By this model of teaching, the researcher found that the teachers have difficulties in : (1) covering the various needs of academic competencies, (2) promoting students active ways of learnin. Involving the teachers, the **action research** is designed to help the teacher to develop model for mathematics teaching in order to be able to solve their problem in facilitating their students. Cockroft Report (1982) suggested that good teaching practice in all level of mathematics education should give opportunities for exposition by the teacher, discussion between teacher and pupils and between pupils themselves, appropriate practical work, consolidation and practice of fundamental skills and routine, problem solving, including the application of mathematics to everyday situations and investigational work '. The research indicated that there are still many stumbling blocks for the teacher to perform teaching practice that meets with the criteria outlined by the Cockroft Report (1982). The results of the research suggest that the teacher may improve her mathematics teaching through facilitating the various needs of students academic competencies, encouraging the students to be the active learners, emplyoing various teaching methods, and developing teaching aids and teaching materials.

Key Words : model of mathematics teaching, exposition method, discussion method, problem-solving, needs of academic competencies, students active learning, teaching aids

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A. Introduction

The Board Outlines of the State Policy (GBHN) lays down that national education needs to be continuously redefined, developed, and strengthened by providing it with the necessary legislation and giving priorities to expansion of opportunities and improvement of the quality education (Ministry of Education and Culture, 1993). Indonesian government strive to improve the quality of all level of teaching by improvement the quality of teachers, the provision of learning facilities and equipment, the improvement of the curricula for basic education, and, the development and utilization of communication technology for education, in support of the teaching-learning process. Over the past two decades many educators have come to the realizations that the quality of education is highly dependent on the quality of the teachers and the instruction they provide (Djalil and Anderson, 1989).

The improvement of the quality of teachers, thus, has been one of the fundamental issues in the improvement of the quality of education in Indonesia. However, the quality of teaching learning process is closely related with what the teacher does in the classroom. In terms of teacher behaviour and competencies the improvements of quality are directly concerned with the teacher's ability to plan and manage the time, to recognize and understand the objectives, to organize and manage teaching and learning through a combination of class activities, to use environment and resources, to use many kinds of teaching methods or approaches, to provide and use teaching-learning feedback and to better assess the process as well as the outcome.

Attempts to upgrade teacher developing teaching models have come up against situations in the classrooms that overwhelm the desired behaviors; where teachers have to cope with large classes, in particular, changes to teaching model which require small group work, experiential, enquiry or experimental activities, may not be practicable because of lack of space, inadequate classroom furniture, absence of equipment, and lack of classroom insulation making even moderate noise levels a disturbance in other classroom. Indonesian educationists see that model of teaching is one of the most important factors affecting the quality of teaching; and, it is one of the factors which are related to school effectiveness. Teachers who have better teaching skills and interpersonal relationship with their pupils may be able to bring about high achievement in their classes. Such teachers may be able to adapt their teaching to the children's level and maintain an industrious

classroom climate.

Preliminary research of secondary mathematics teaching indicated that mathematics classroom 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. The teachers seem not to have sufficient competence to carry out the teaching-learning processes they planned; these include lack of understanding of the theories of teaching and of how to implement many kinds of teaching-learning model and misinterpretations of the concepts of active-learning processes (Wardani, 1995). Although it is indicated that this direct instruction is effective for increasing student achievement of lower-level skills in mathematics (Rosenshine, 1979 in Grouws, et al. 1988), it is insufficient for enhancing achievement of higher level skills; higher-order thinking may require a less direct instructional approach.

The schools of developing countries are littered with the remnants of attempts to change the quality of teaching; well meant but inappropriate reforms of syllabuses, teacher training, teaching styles, inspection systems and examinations have been marked by considerable failure (Guthrie, 1986). Attempts to upgrade teacher quality by requiring changes in teaching style have come up against situations in the classrooms that overwhelm the desired behaviours; where teachers have to cope with large classes, in particular, changes to teaching styles which require small group work, experiential, enquiry or experimental activities, may not be practicable because of lack of space, inadequate classroom furniture, absence of equipment, and lack of classroom insulation making even moderate noise levels a disturbance in other classroom (ibid, p. 7).

Based on the weakness of traditional practices of teaching learning process at school, many efforts have been made in Indonesia to improve classroom approaches by making learners more active. The challenge for Indonesian educationist 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). Therefore, it seems that secondary mathematics teaching in Indonesia needs to look for the model of good teaching; and that challenge to change is one of the crucial issues in the efforts of improving the quality of teaching by changing teaching styles.

B. Theoretical Review

The Cockcroft Report (1982), a comprehensive and thorough report on the teaching of mathematics, produced the recommendations that mathematics teaching at all levels should include opportunities for: exposition by the teacher; discussion between the teacher and pupils and between pupils themselves; appropriate practical work; consolidation and practice of fundamental skills and routines; problem solving, including the application of mathematics to everyday situations; and investigational work. The structures in a traditionally-organized classroom can be linked readily with the routine classroom activities of teacher-exposition and teacher-supervised desk work (Philips in Edwards 1987). If the teacher wants to introduce new ideas or skills s/he may feel it is appropriate to carry out teacher-led discussion. In this case the teacher may be faced with difficult styles of classroom interaction. Bain, (1988), gave the description of this teacher-led discussion as : individual pupils have difficulty concentrating because they are not fully involved, shy pupils will fear exposure, the teacher is wholly occupied and the progress of the entire class can be interrupted by the misbehavior of a single pupil. On the other hand, if discussion takes place in a group, as he suggests, individual pupils have far more opportunity to speak, pupils are more likely to develop their answers, pupils are more involved and therefore less likely to have problems with their concentration, shy pupils can speak with less fear of exposure, the teacher is freed to monitor/intervene/assess /talk to individuals, the teacher can deal with distractions and misbehaviour without stopping the work of the entire class.

For exposition to be successful, the learners need to concentrate on the teacher's argument. This is most likely to occur when learners are interested (Backhouse, et al, 1992). Further, they stated that since we cannot all be interesting all the time, learners need to have the self-discipline to listen; however, exposition is most frequently used for just a short part of a lesson, very often with practice exercises. The power of exposition can be seen from its usefulness: (1) when starting a new subject with a class, before their different speeds of working have separated them in their achievement; (2) when collecting ideas together after an investigation or some practical work; (3) to set up challenges for learners and to get them to think; (4) to stimulate a discussion, an investigation or practical work.' (Backhouse, et al., 1992, p. 130). Four reason why exposition methods are popular with teachers: firstly, they are mathematically neat and complete as each lesson contains a presentation and explanation of mathematics which lead to a conclusion; secondly, they boost the

teacher's self esteem as he is the fount of knowledge; and thirdly, a teacher can get satisfaction from presenting a complete syllabus in a sequence of lessons; and the teacher himself has often successfully learnt school mathematics in this way and expects his pupils to do likewise(Dean, 1982, p. 77)

In discussion the teacher does not act as the sole arbiter; all participants are able to put forward their ideas, and to build on and evaluate the contributions of others (Shuard, 1986). The Cockcroft Committee took the view that it is only by discussion that learners can see how the different topics which are found within mathematics are inter-related (Backhouse et al. 1992). Pirie and Schwarzenberger (1988) in Backhouse et al. (1992) have given a useful definition of mathematical discussion as : purposeful talks; on a mathematical subject in which there are genuine pupil contributions; and interaction. Further, they stated that discussion is useful in many ways, including : for the clarification of concepts; to clarify the nature of a problem in order to understand exactly what is being asked; to decide what data are relevant to a problem; to decide on a strategy for problem solving; while working on a collaborative practical task or project; while working at a microcomputer; to find out what has gone wrong in the solution of a problem. Afterwards, they warned that many teachers talk about having a class discussion when they are really just asking questions and receiving short answer.

Skills may be available when they are needed for problem solving and investigation and it is necessary that pupils not only know how to carry them out, but when to use them and the purposes for which they can be used (Shuard, 1986). We have no doubt that practice is necessary to acquire and retain skills; the question that needs to be asked is not 'Is practice a good thing?' but 'How should learners be given the opportunity to gain practice?' (Backhouse et al., 1992). However, the solution of a mathematical problem cannot begin until the problem has been translated into the appropriate mathematical terms. This first and essential step presents very great difficulties to many pupils - a fact which is often too little appreciated (Cockcroft Report, 1982, para. 249)

The Report was clearly concerned that problems should relate both to the application of mathematics to everyday situations within the pupils' experience, and also to situations which are unfamiliar (ibid, p.137). Ebbutt and Straker (1995) defined problem solving as using and applying mathematical knowledge and skills to tackle the unfamiliar: choosing appropriate skills, devising suitable methods, using relevant facts, and so finding solutions to completely new problems. A problem is a situation

that has interest and appeal to a child, who therefore wishes to explore the situation more fully in order to gain understanding of it (Orton and Wain, 1994). Working on and solving problems is a very effective way of learning mathematics (Ebbutt and Straker, 1995). Further, they suggested that mathematical problems, on the other hand, focus on the mathematics itself, and on the process of arriving at the solution; the actual result or answer may not be used for any purpose. If children are to apply mathematical concepts, knowledge and skills successfully, they need to develop their skill in the processes of mathematical activity: reasoning, organising, classifying, recognising pattern, and many others (ibid, p.34).

Lester (1989) in Orton and Wain (1994), makes the points that problem solving in the real world usually is sustained by the fact that the contexts in which the problems are embedded make sense to the problem solver; the challenge to the teachers lies in their ability to create real problems which are part of pupils' reality. Orton and Wain (1994) gave the criteria of the kind of problems which can be classified as 'real' : the problem should be posed by pupils; pupils should wish to solve the problem for its intrinsic worth; the problem should be meaningful for the pupils, not just for the teacher; the problem should have relevance to pupils' everyday life in and out of school; the method of solution should not be immediately apparent and there may be many solutions, each depending on the method chosen.

Although the Cockcroft Committee regarded problem solving and investigation as essential elements of mathematics teaching, they did not clarify the distinction between them, nor did they offer much practical advice about their teaching (Shuard, 1986). Investigative work provides rich experience of the processes involved in mathematics; investigative work as an activity in which teachers can learn more about the ways individual learners' minds work (Backhouse et al. 1992). There are four discovery methods of mathematics teaching , namely, directed discovery, guided discovery, exploratory discovery and, last but not least, free discovery (Dean, 1982). Roughead and Scandura (1978) in Bell et al. (1983) asked what it was which accounted for the superiority of discovery-learning; they concluded that it was the learning of how to approach problems of the types concerned, and argued that these methods and approaches might be taught equally or more effectively by exposition.

We need to regard the pupils as central to our concerns if our provision for all the pupils is to be appropriate and effective; some aspects of teaching for appropriateness for students might be:

matching their state of knowledge, identifying and responding to their particular difficulties, extending them to develop their potential in mathematics, providing some continuity of teaching with a demonstrated interest in progress, developing an awareness of themselves as learners using the teacher as a resource, and providing regular feedback on progress (Ashley, 1988). Those who teach mathematics must take into account the great variations which exist between pupils both in their rate of learning and also in their level of attainment at any given age (Cockroft Report, 1982, para. 801).

The importance of awareness, diagnosis and appropriate strategies for meeting needs is easy to state but is likely to be difficult to execute, with the certain demand on time and probable need for skills which may not be well developed (Ashley, 1988). Teachers' expectations to provide pupils needs is consistently expressed by the way they organize classrooms and resources. Do resources such as textbooks have a part to play in responding to pupils needs ? Textbooks provide valuable support for teachers in the day-to-day work of the classroom; they can provide a structure within which work in mathematics can develop and provide ideas for alternative approaches (Cockroft Report, 1982, para.312).

It is essential to improve the overall quality of the mathematics teaching force; this mean that active efforts must be made to attract more well qualified mathematicians into the teaching profession, to retain those mathematics teachers who are well qualified and effective, and to provide increased levels of in-service support and training (Cockroft Report, 1982, para. 802). Good support at classroom level is essential for all who teach mathematics; this requires not only the provision of adequate teaching facilities and equipment, but also good leadership by 'headteachers' and 'inspectors'.

Proctor, et. al. (1995) suggested that a mix of methods makes for effective classroom practice where children are : clear about what they are doing and why they are doing it; clear about what is expected of them in terms of quality and quantity of work completed; confident that their learning efforts will be properly supported, their questions answered and difficulties dealt with; and teachers, convey their appropriately high expectations for achievement and behaviour to their pupils. While Hoyles in Grouws and Cooney (1988) concluded that mathematics teaching is about facilitating the learning process of pupils, and thus good teaching requires a combination of subject competency, a flexibility of teaching style and strategy, and a concern for the emotional and social as well as the

cognitive need of pupils. Further, she suggested that this requires the use of a range of teaching styles and a focus on pupils' conceptions and ways of working as well as on mathematical content. This is actually in accordance with what the Cockcroft Report suggested that it is not possible to indicate a definitive style for teaching of mathematics (ibid, p.158). The report also suggested that approaches to the teaching of a particular piece of mathematics need to be related to the topic itself and the abilities and experience of both teachers and children; that methods which may be extremely successful with one teacher and one group of children will not necessarily be suitable for use by another teacher or with another group of children (ibid, p.158).

Nickson in Grows et al. (1989) concluded that to be an effective teacher of mathematics is not a rigid state but requires continuous evaluation and flexibility, and the adaption of particular content and methods to particular students within a particular setting. Shulman (1970) and Ausubel (1968) in Bell et al. (1983) point out that it is possible to discover facts which are intrinsically non-meaningful and, on the other hand, that material can be assimilated meaningfully into existing knowledge even if learnt from an expository presentation.

B. Method of Research

The main purpose of the research is to actively improve practice of mathematics teaching on the basis of ideal position of good model of secondary mathematics teaching and on the basis of assumption that the teacher can learn and create knowledge through his/her concrete experience and observing and reflecting on that experience. The striking benefits of the research therefore is that understanding of the teacher and the situation of teaching learning processes is to be improved. Teacher is perceived to be co-worker in doing research and the researcher is not considered to an outside expert. Thus, the approach of the research is an evaluative-reflective-participatory-critical collaborative enquiry of teaching.

The process of action research includes problem analysis and a strategic plan, implementation of a strategic plan, observation and evaluation of the action by appropriate methods and techniques, reflection on the results of the evaluation and on the whole action and research process (Zuber and Skerritt, 1992). Due the process lead of a new problem hence the researcher carried out 5 (five) new

cycle of planning, acting, observing and reflecting. The researcher needs to fill in the specific conditional features for each level that pertain to the chosen area of action. Although there are multiple perspectives from which research on teaching can be approached and multiple interpretations of teaching act, one underlying theme needs to be more adequately addressed (Koehler and Grouws in Grouws, 1984). This study bounds territory in which events or processes occurring over a specified period. The framework of research is action in the mathematics teaching of Senior High School grade I.

The research covers the following action (Zuber and Skerrit, 1992) : (1) identifying and analyzing problems arising in mathematics teaching learning processes, (2) designing the strategies for solving the problems as a results of symmetrical communication among the researchers and the teacher, (3) implementing and testing the strategies, (4) evaluating the effectiveness of the strategies, (5) reflecting the results, (6) arriving at conclusion and/or newly identified problems, (7) repeating the cycle until they were with the improved practice, (8) reporting the findings.

C. FINDINGS AND ANALYSIS

1. Cycle One (Topic: Linear Equation System With 2 Variables, Numb.of Students=40)

Contextualization Clues:

1. Teacher employs classical teaching methods and delivering the questions to explain the concepts of Linear Equation and to maintain students attention.
2. Low tones of teacher's voices some times make the students in the back part of the class Pay less attention; however, teacher expects that the class should be in order, silence and pay more attention.
3. Teacher initiated to deliver the questions; however, most of the students has no response to the teacher's questions.
4. Teacher seemed to have difficult to control the students which sit in the back part of the class.
5. Teacher depended greatly on using the text-books as the reference to take the problems.
6. There was no grouping; however, there were some discussion activities among the students out of teacher's monitoring.

Identifying Problems :

Teachers have difficulties in : (1) covering the various needs of academic competencies, (2) promoting students active ways of learning, (3) developing teaching aids.

Strategies for Action in the Cycle II :

1. Facilitating the various needs of academic competencies :
 - a. to develop “work-sheet” for students
 - b. to promote discussion method of teaching
2. Encouraging the students to be active learners :
 - a. to develop “work-sheet” for the students
 - b. to develop learning in group
 - c. to intensify and monitor student assignments and homeworks.
 - d. to promote discussion method of teaching
 - e. to extent problem solving activities

2. Cycle II (Topic: Determinant, Numb.of Students=40)

Contextualization Clues:

1. Teacher has tried to develop Works-Sheet. The teacher prepared the work-sheets and distributed them to each of the students; then divide the class into 10 groups consisted of 4 (four) students; and let them to solve the problems that listed in the work-sheet.
2. There were some questions from the students whenever the teacher came into their group.
3. Teachers depended heavily on Text-Books for producing the mathematics problems.
4. There still was no schema to encourage discussion, but some students seemed to have involved in discussion activity out of teacher monitoring; in general, they did it after they finished solving the problems and whenever they found that the problem was difficult enough to solve.
5. Teacher pointed out 4 (four) students from different groups to write their results of solving the problems at the black-board.
6. Teacher employed classical method to explain solving the problems.

Identifying Problems:

1. Students raised more questions whenever the teacher develop work-sheets
2. Teacher had more choice of activities to be done whenever he develop work-sheets
3. Students more actively learned mathematics from the work-sheets
4. Teacher seemed difficult to encourage discussion activities
5. Grouping the students to have the characteristics of “pseudo-grouping”
6. The limited functions of work-sheets i.e as the collection of the mathematics problems.

Strategies for Action in the Cycle III :

1. Accomplishing the various needs of academic competencies :
 - a. to develop “work-sheet” for students
 - b. to promote discussion method of teaching
 - c. to develop learning in group
 - d. to guide individual student
2. Encouraging the students to be active learners :
 - a. to develop “work-sheet” for the students
 - c. to develop learning in group
 - d. to intensify and monitor student assignments and homeworks.

- e. to promote discussion method of teaching
- f. to extent problem solving activities

3. Cycle III (Topic: Matrices, Numb.of Students=40)

Contextualization Clues:

1. Teacher encouraged the students to learn in group
2. Teacher has tried to develop Works-Sheet. The teacher prepared the work-sheets and distributed them to each of the students; then divide the class into 10 groups consisted of 4 (four) students; and let them to solve the problems that listed in the work-sheet.
3. Teacher depended heavily on Text-Books for producing the mathematics problems.
4. Teacher instructed the students to solve the problems listed in the work-sheets
5. Teacher carried out classical method to discuss solving the problems by tightly controlling the students to give pay attention to the teacher.
6. Teacher frequently delivered closed-questions; while the students answered choirly.
7. Classically teacher's explanation seemed to have no relation with the students' works in their groups.

Identifying the Problems :

1. The students take the benefits from working in the groups, although it was considered as "pseudo-group"
2. It was difficult for the teacher to develop various kinds of works-sheets.
3. It was difficult for the teacher to use works-sheets for encouraging discussion among the students.
4. There was an indication that the teacher seemed to have a longing for her habit to teach using single method "exposition"
5. The text-books have its important role for the teacher to find out mathematics problems.
6. Students raised more questions whenever the teacher develop work-sheets
7. Teacher had more choice of activities to be done whenever he develop work-sheets
8. Students more actively learned mathematics from the work-sheets
9. The limited functions of work-sheets i.e as the collection of the mathematics problems.

Strategies for Action in the Cycle IV :

1. Accomplishing the various needs of academic competencies :
 - a. to develop "work-sheet" for students
 - e. to promote discussion method of teaching
 - f. to develop learning in group
 - g. to guide individual student
2. Encouraging the students to be active learners :
 - a. to develop "work-sheet" for the students
 - g. to develop learning in group
 - h. to intensify and monitor student assignments and homeworks.
 - i. to promote discussion method of teaching
 - j. to extent problem solving activities

4. Cycle IV (Topic: Matrices, Numb.of Students=40)

Contextualization Clues :

1. Teacher divided the class into 10 (ten) groups
2. Teacher prepared one work-sheets for each group (all are the same work-sheets)
3. Teacher instructed the students to work together in their group to solve the problems listen in the work-sheets.
4. Teacher pointed out some students from different group to write down their solution at the black-board.
5. Teacher cheked the students works at the black board
8. Teacher frequently delivered closed-questions; while the students answered choirly. Some teacher's questions were difficult enough to answer by the students.
9. Teacher gave the students homeworks; the teacher toke them from the text-books

Identifying the Problems :

1. The sudents take the benefits from working in the groups, although it was considered as "pseudo-group"
2. It was difficult for the teacher to develop various kinds of works-sheets.
3. It was difficult for the teacher to use works-sheets for encouraging discussion among the students.
4. It is difficult for the teacher to develop the schema for communication among the group.
5. There was an indication that the teacher seemed to have a longing for her habit to teach using single method "exposition"
6. The text-books have its important role for the teacher to find out mathematics problems.
7. Students raised more questions whenever the teacher develop work-sheets
8. Teacher had more choice of activities to be done whenever he develop work-sheets
9. Students more actively learned mathematics from the work-sheets
10. The limited functions of work-sheets i.e as the collection of the mathematics problems.
11. The students were starting to have a habit to work together in the same group.
12. The students were starting to be active learners

Strategies for Action in the Cycle V :

1. Accomplishing the various needs of students academic competencies :
 - a. to develop "work-sheet" for students
 - b. to promote discussion method of teaching
 - c. to develop learning in group
 - d. to guide individual student
 - e. to develop the schema for communication among the group
2. Encouraging the students to be active learners :
 - a. to develop "work-sheet" for the students
 - b. to develop learning in group
 - c. to intensify and monitor student assignments and homeworks.
 - d. to promote discussion method of teaching
 - e. to extent problem solving activities

5. Cycle V (Topic: Matrices, Numb.of Students=40)

Contextualization Clues :

1. Teacher divided the class into 8 (eight) groups
2. Teacher prepared one work-sheets for each group (all are the same work-sheets)
3. Teacher instructed the students to work together in their group to solve the problems listen in the work-sheets.
4. Teacher pointed out some students from different group to write down their solution at the black-board
5. Teacher cheked the students works at the black board
6. Teacher frequently delivered closed-questions; while the students answered choirly. Some teacher's questions were difficult enough to answer by the students.
7. Teacher gave the students homeworks; the teacher toke them from the text-books
8. Classically teacher's explanation seemed to have no relation with the students' works in their groups.

Identifying the Problems :

1. The sudents take the benefits from working in the groups, although it was considered as "pseudo-group"
2. Teacher has tried to develop work-sheets for teaching mathematics; however she has a difficulties to develop the schema how to encourage discussion in and between the group.
3. By developing work-sheets for teaching mathematics, the teachers seemed to have more alternative for doing activities.
4. There was an indication that the teacher seemed to have a longing for her habit to teach using single method "exposition"
6. The text-books have its important role for the teacher to find out mathematics problems.
7. Students raised more questions whenever the teacher develop work-sheets
8. Students more actively learned mathematics from the work-sheets
9. The limited functions of work-sheets i.e as the collection of the mathematics problems.
10. The students were starting to have a habit to work together in the same group.
11. The students were starting to be active learners

Strategies Action for Post Research :

1. Accomplishing the various needs of students academic competencies :
 - a. to develop "work-sheet" for students
 - b. to promote discussion method of teaching
 - c. to develop learning in group
 - d. to guide individual student
 - e. to develop the schema for communication among the group
2. Encouraging the students to be active learners :
 - a. to develop "work-sheet" for the students
 - b. to develop learning in group
 - c. to intensify and monitor student assignments and homeworks.
 - d. to promote discussion method of teaching

e. to extent problem solving activities

D. DISCUSSION

General picture of mathematics teaching prior the action research, reflected by the teacher, was that the teacher implements classical teaching method predominantly by exposition method in the cycle of explaining, questioning, and giving the students assignments. By such kind of teaching methods, the preliminary research indicated that the teachers have difficulties in : (1) covering the various needs of academic competencies, (2) promoting students active ways of learning, (3) developing teaching aids. As the subject of the research, it was indicated that the teacher strive to understand the basic concepts of good practice of mathematics teaching introduced by Cockroft Report (1982).

Due to the fact that its concepts of teaching came from different context of teaching (British Context) and it consists of deepen aspect of philosophy and ideology of teaching , the teachers perception of aspect of this styles of teaching seemed to have differences with the original ones. The strong external factor such as educational system and the school environment as well as the society make the teacher uneasy to develop her creativities in promoting good teaching. The teacher understands that her single method of teaching needs to be improved; however it is uneasy for her to change her habit. In this action research, the teacher has greatly tried to improve her teaching through the cycles of research. Having had the discussion on the contextualization clues and the diagnostics with the other researcher in each the end of the cycles, the teachers has strived to develop the schema as it was agreed before.

From this research we can learn that the the teacher has the difficulties in : developing function of work-sheets, developing the schema for communicating among the group, and developing the teaching aids and teaching materials. It seemed that the teacher has no strong basic knowledge how to develop them. The work-sheets to be developed by the teacher merely the collection of mathematics problems; she has the difficulties to make use the work-sheets for other purposes such as for promoting problem-solving, for promoting investigation and finding the pattern. The teacher also has difficulties how to form groups and how to manage them. The learning groups forming by the

teacher were characterized as “pseudo-groups” that are not the real group in effect.

Students’s need of various academic competencies can be the need for questioning and communicating as well as their expectation of what happened in the class. The observation indicated that whenever the students do not have the chance to raise their questions, they then tend to do another activities or to deliver his/her questions to his/her classmates. Whenever the teacher implement a single method of teaching as it was stated above, the teacher has the difficulties to cover those various academic competencies of their students. One of the way to overcome this problem, in this research, is to give the chance to the teacher to develop work-sheets. It seemed that both the teacher and their students take the benefits of using the work-sheets; however, the implication of developing the work-sheets by the teachers to the accomplishment of the needs of various academic competencies was characterized as not direct implication because there was no schema of it developed by the teacher. Developing the work-sheets by the teacher encourage the students to actively learn mathematics through solving the problems. Whenever the teacher lets the students to work in group, the students seemed to have a chance to communicate to each other. The students begun to have a discussion if they found that the problems is difficult enough to solve. Factors that the teachers has difficulties in developing the schema for encouraging discussion activities are lack of teacher’s understanding of genesis of what is called ‘discussion’ and how to implemen it in teaching learning processes.

E. CONCLUSION

Investigating and developing good practice in Secondary Mathematics teaching through action research give the teacher the chance to develop model of teaching learning processes in order to be able to improve the quality of mathematics teaching. However, the research noted that there are still many stumbling blocks for the teacher to perform teaching practice that meets with the criteria outlined by the Cockroft Report (1982). The results of the research suggest that the teacher is to improve her mathematics teaching through facilitating the various needs of students academic competencies, encouraging the students to be the active learners, employing various teaching methods, and developing teaching aids and teaching materials.

Specifically, this research recommend that the teacher may : (1) Facilitating the various needs of students academic competencies through developing the “work-sheet” for students, promoting discussion activities, developing students learning in groups, guiding individual student, and developing the schema for communication among the groups; (2) Encouraging the students to be active learners through developing the “work-sheet” for the students, developing students learning in groups, intensifying and monitoring student assignments and homeworks, promoting discussion method of teaching, and extending problem solving activities

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