Developing ICT for Primary and Secondary Mathematics Teacher Professional Development: The Use of VTR in Lesson Study

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ABSTRACT

Most (mathematics) teachers candidates have little opportunity to observe effective teaching in an actual classroom as many of their first learning experiences were based in a traditional classroom where rules were applied methodically to solve problems. In other words, they lack the experience base to meaningfully observe the classroom's complex and rapid interactions. The use of video tape recorder (VTR) is one of the aspects of developing ICT to promote teachers professional development. Through Lesson Studies activities, some Indonesian teachers have experiences to reflect their teaching through VTR. Reflecting good teaching practice of mathematics form different context through VTR was proved to evidently encourage and motivate teachers to improve their teaching competencies. In some parts of the activities of teachers professional development programs in Indonesia, year 2002- 200, the reflections through VTR of Japanesse context and Indonesian context resulting teachers' perception that it was a good model of mathematics teaching that can possibly be implemented in Indonesia. However, the techers were aware that to implement such good model there are some fundamental constraints should be overcome.

Key Words: ICT, VTR, professional development, mathematics teacher, lesson study

OVERVIEW

VTR (Video Tape Recorder) for teacher education and reform movement in Mathematics Education, specifically for developing lesson study has some benefits as: a) short summary of the lesson with emphasis on major problems in the lesson, b) components of the lesson and main events in the class, and, c) possible issues for discussion and reflection with teachers observing the lesson (Isoda, M., 2006). According to him, a Lesson Study is divided into three parts: a) planning the lesson, b) the observation part, and, c) the discussion and reflection part.

Further he stated that when we use the VTR, we also begin from the

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lesson observation but the VTR itself already loses many dimensions, parameters and context because the program is prepared (recorded) from the perspective of the recorder's and VTR editor's eyes only. Through the observation of the VTR, we learn things and apply these in the next activity. Teachers in Indonesia can observe the lesson of different context in different country (e.g. Japan) through VTR.

If we observe teaching learning processes through VTR, a short summary is necessary to grasp the contents and we need to observe the VTR several times to understand its contents clearly. Having done this, it may arrise the usefull issues for discussion and reflection as well as to reflect on good practices, good lessons or innovative lessons for the reform of mathematics education.

> In the process of pre-service teacher education, it is important to develop teacher's perspectives. Learning to listen is a key word for this approach. In the case of Japan, lesson study usually begins by developing a lesson plan. At this stage, teachers solve and pose problems from students' perspectives. By analyzing problems, teachers develop good ways of questioning. For writing the description of the VTR, it is very important to ask why? Why did students say this? Behind their words, there must be so many kinds of ideas. Why did the teacher say that? Through these questions, we can better know and understand the hidden features of the lessons being observed through VTR. Then, it is very important to add the format such kinds of descriptions from the view points of original lessons but even if we add descriptions we do not needs to follow because re-contextualization is done by VTR users. (Isoda, M., 2006)

With the video case studies, we had the chance to *observe* what we learned in class and from reading the book, and then watch how you can *apply* [student emphasis] it to teaching and learning in the classroom. When you see a teacher actually implement a theory or concept into everyday lessons, you realize just how vital everything is that you study, and you learn methods and collect ideas of how you can actually implement these into your own classroom.

When you read it, you do not fully understand how to apply it or what happens when you do until viewed in one of these video case studies. (Cannings, T and Talley, S, 2003).

THEORETICAL REVIEW ON DEVELOPING ICT FOR MATHEMATICS TEACHERS PROFESSIONAL DEVELOPMENT

The National Council of Teachers of Mathematics in *Principles and Standards for School Mathematics* (NCTM 2000) identifies technology as a guiding principle for the teaching and learning of mathematics and calls for teachers to use technology to support a strong learning environment. The current focus on teacher professional development and the need for stronger mathematical content support provide a basis for using technology to make the connection to support teacher educators. The nature of these problems points to continued professional development along with proper support as a solution. The appropriate use of technology can assist mathematics educators in deepening understanding of mathematical content and delivery, lesson development, and collaboration. This initiative directly impacts students and their mathematical experiences. (Wilkerson, T.L. and Rogers, W.D., 2003)

The Strategy on the Implementation of Information and Communication Technologies (ICT) into Mathematics Education can be developed in an extensive effort in promoting teacher professional development. The strategy to provide an extensive vision on ICT use and its systematic introduction into different areas of education may consider the following areas of education: (1) the relationship between society and education; (2) life at school; (3) contents and methods of education; (4) provision for computer equipment and learning aids; (5) the teacher's role and qualification; (6) the connection between science and education; (7) management and funding of ICT implementation. Teacher training in respect of ICT is one of the most important parts. (Informacijos 2000

in Dagiene, V., 2003).

What are the main goals and scopes for the promoting ICT to mathematics teacher professional development? We may have been concentrating on the following issues: (1) to provide conditions for all teachers to obtain the complete ICT literacy and skills to apply new technologies and modern teaching methods in education, (2) to pay special attention to in-service of informatics teachers and ICT coordinators in order to acquire and constantly improve their professional qualifications, (3) to develop an effective and flexible system of teachers' in-service training and life-long learning and to provide adequate pedagogical and technical in-service training for all teachers, (4) to develop teacher education to face the demands of the information society, (5) to develop digital learning materials for teachers, (6) to provide pedagogical support for teachers, (7) to change the role of school librarians and appoint them the position of school information center and information skills education specialist, (8) to develop a several-level system of incentives for all teachers who apply ICT in education.

Even when the use of ICT, though with differing modes and characteristics, enters into teaching practice, one often observes purely superficial changes which do not impact the effective renewal of the syllabuses and methods, i.e. the modification of the methodological approaches, the content and relational dynamics in classes and schools, and the organizational aspects within schools (Bottino and Furinghetti 1999). This situation is not substantially different from that in other European countries (Mallon 2002). One can observe that the government programme for the development of educational technologies has achieved significant results in providing schools with technology infrastructure and a considerable number of teachers with ICT basic skills. Nevertheless this has not lead directly to an improvement of teaching and learning methods and to a change in approaching discipline

subjects. A direct relationship cannot be established between provision of infrastructure and ICT training, and the effective pedagogical use of technology in schools. This last goal is less clearly supported by governmental polices and needs a careful consideration of related difficulties and possible interventions. (Bottino, M.R.2003)

As far as teacher training is concerned, the first widespread initiative by government is needed. This was a centralized plan for in-service mathematics teacher training whose aim was to provide basic computer science literacy. This training plan was enacted through courses for teachers in which traditional lessons alternated with computer practice. The method used was a "pull-down" one (i.e. the training program is operated through trainers who are in-service teachers specifically trained for this purpose). What appears to be far more effective is to bring teachers as quickly as possible to a point where they can feel, recognize and begin to appreciate the relevance of computers to their own classroom practice in their own subject areas. Once teachers get acquainted with how the proper use of ICT can make a real contribution to their professional work, the motivation to acquire fresh technical knowledge is easily developed.

As often as not there is a danger that teacher training emphasizes the technical skills of the teachers, where the aim is to learn to use certain software like spreadsheets or word processors. Learning these technical details can be organized on a local level, while concentration on pedagogical issues is more important and has a deeper influence on the work at school. So the most important element in a new approach to teacher training is not to concentrate on teaching of technical knowledge and skills but rather on rendering of the principles by which the students' learning has to be improved. For this reason, the main priority in teacher training is given to the design of electronic educational materials that are compatible with the compulsory school

curriculum subjects. The material prepared for developing VTR can be designed on the basis of the following criteria; (1) the material was easily found and played, grouped into small portions in order that the reader could easily make breaks during the process of learning; (2) there were following reflections, exercises, and other tasks added to the use of VTR in order that the reader teachers constantly examine his or her own teaching. (Dagiene, V., 2003)

THE USE OF VTR IN LESSON STUDY ACTIVITIES: Japan and Indonesian Context

The Lesson Studies, as one of teachers' professional development activities, were developed in which the teachers, in collaboration with Lecturers and , tried out some teaching models at schools. The Lecturers of Teacher Training Program and School Teachers worked collaboratively, composes some numbers of Lesson Studies. The grounds of the Lesson Study activities were reflecting and promoting the new paradigm of the secondary mathematics and science education, in which learning activities are not only perceived pragmatically and short-time oriented but also to be perceived as a long-life time purposes.

The objectives of those Lesson Study activities were to contribute the improvement of secondary mathematics education by pursuing good practice of mathematics teaching. Lesson Studies for secondary mathematics were carried out by mainly Classroom Action Research approach. They carried out to improve the teaching learning practices and to find more appropriate methods for facilitating students learning. Teachers' experiences have been shared with other teachers and the lectures. The specific objectives of Lesson Study activities are: (1) to develop instrument and equipment for teaching learning process, (2) to develop teaching method and model for teaching learning process, (3) to

develop teaching material for teaching learning process, and (4) to develop teaching evaluation for teaching learning process.

Lesson Study activities let the teachers to reflect and evaluate, in cooperation with lectures or other teachers, their paradigm of teaching. Approaches of Lesson Studies covered (a) students cooperation with others in their learning, (b) contextual teaching and learning, (c) life-skill, (d) hands-on activities, (e) interactive process oriented curriculum and syllabi development, and (f) teachers and students autonomous. From those three sites of study, there can be produced the notions of educational improvement, in term of teacher, student and lecture.

Japanese Context of VTR

At the beginning of each of those activities, the author played the Japanesse VTR of Lesson Study produced by "CREAR" of DIRECT NETWORK NICHIBUN, to reflect teachers' perceptions and to understand the extent it influences teachers' following activities.

Lesson : Choosing Tasks according to Pupil's Interests (4th grade)

Teacher : SAITO, Kazuya

School: Ookayama Elementary School, Yokohama city

Unit : The area of plane figures

Method : Tasks based on pupils' interests.

The objectives:

1. Pupils appreciate the formulas for the area of figures and are willing to use the formulas in order to find the area.
2. Pupils are able to find the area making the best use of their prior knowledge and experience.

3. Pupils are also able to formulate the methods to find the area of parallelograms.
4. Pupils can find the area of fundamental Figures efficiently.
5. Pupils understand the methods to find the area of fundamental figures.

Highlighting the VTR:

	Teacher posed the problems as follows:
	Can you find the area of the figure? If you think about how this figure is made? Pupils begin by reflecting on their prior knowledge.' experience, and the opportunity to learn about area in the previous grade. Pupils make a plan how to decompose the figure in the problem into square, rectangle, right-angled triangles,
	triangles, parallelogram, or trapezoid, in order to find the area of the figure.

	Pupils realize that they have to begin by learning how to find the area of triangles. Pupils discuss how to decompose the figure. Then, they do the problem separately in three groups as follows: • The figure in the problem can be decomposed into right-angled triangles and rectangle. • The figure in the problem can be decomposed into a few' triangles. • The figure in the problem can be decomposed into triangles and parallelogram, or trapezoid.

	Pupils formulate the methods to find the area of scalene triangles Pupils try to find the area of quadrilaterals using the formula for the area of triangles. Pupils shall find the area of quadrilaterals using

	Pupils use parallelogram to find the two congruent triangles area of rectangles, and by a diagonal line, pupils shall solve the problem.

	Pupils try to find the area of parallelograms.

	Teacher ancouraged the pupils to consider how to find the area of rhombus an trapezoid.

Indonesian Context of VTR

Primary School : SD Percobaan 2 Yogyakarta, Indonesia

Grade/Sem/year : IV/Sem I/2006

Teacher : Budiyati

Number of Students: 44

Standard Competency : To Understand and to apply factors and multiple of numbers to solve problems.

Base Competencies : 1. to understand the Least Common Multiple (LCM)
2. to determine the Least Common Multiple (LCM)
3. to solve problems which is related to LCM

Introduction:

Apperception (prepare for emotional and awareness)

- Teacher started the lesson by delivering the question of whose the students have routine activities.

Preparing for group discussion:

- The teacher distributed prepared problem written in Worksheet to every student. The teacher let the student first worked individually i.e. read and learn the contextual problem in calendar format:

Developing in Group Discussion:

- The teacher let the students to have group discussion to solve the problem..

Monitoring developing in group discussion

- The teacher let the students to develop their own methods and resources
- The teacher let the students to continue to solve the problem as home-work.

CONCLUDING REMARK

In general, the activities of reflecting Japanese context of mathematics teaching through VTR in the training program were perceived as good and useful by the teachers. The teachers perceived that such activities need to be socialized to other districts in order that more teachers can learn it. They perceived that the teaching reflected in the VTR was a good model that can also be implemented in Indonesian context. However, they perceived that it is not easy to implement it.

Teacher perceptions on reflecting the VTR: a. the VTR was a good model of teaching mathematics, b. the VTR is a good model and it needs to be socialized to other teachers, c. they are willing to discussed it to their colleagues after the training, d. the teaching in the VTR is a good model but there are still some constraints to implement it coming from teachers' lack of time, un-

readiness of the students, the limit of budget, lack of educational facilities. Teachers expressed that they were optimistically able to implement this good model of teaching by additional time of teaching and developing lesson preparation. They suggested that to implement this good model of teaching, they need to improve their competencies of teaching contents.

Teachers' perceived that following up the training they will discuss the VTR with their colleagues. They will disseminate the results to other teachers and discuss the VTR in the teachers club. They said that they will try to improve their teaching covers: improving Lesson Preparation, Student Work Sheet, teaching content and teaching methodology. Teachers' perceived that they will develop teaching model after the training in the frame work of Realistic Mathematics Education and Constructivist approach. Teachers also stated that they will develop discussion and demonstration methods as well as various methods.

According to teachers, most of the students are not ready or not able to present their ideas; it takes time for them to accustom to do that. Most of the schools are lack of educational facilities and teachers need to be able to develop teaching media. The most difficult one to implement such good model of teaching practice is about time allocation. Some teachers perceived that it is not easy to take in balance between achieving students' competencies and considering their processes of learning. Meanwhile, a teacher still should facilitate a lot number of student i.e. forty students per class.

The teachers hoped that the schools and government support their

professional development including the chance to get training, to participate the conferences, to participate in teachers club. The teachers perceived that in the teachers' club they are able to discuss and develop lesson plan and students worksheet. Teachers suggested that teachers' professional development programs should be based on teachers' need; and therefore, it needs such a need assessment prior the programs. They also hoped that the schools and government procure educational facilities and improve their salary.

Even if it is not possible to define a single strategy for promoting good teaching mathematics, learning from VTR, there are some general indications can be outlined:

1. It needs to promote co-operation among teachers, researchers in educational technology and in discipline subjects, administrators, trainers, parents, etc.
2. It needs to increase investments in research and development and in the creation of new learning environments for working together.
3. It needs to promote the collection, documentation, and diffusion of good practice examples. There is a mounting interest in aspects related not only to software design, but also to the definition of ways of use suited for exploiting software features in order to accomplish meaningful teaching and learning activities.
4. It needs to promote the study of models for effective dissemination of successful pilot projects is needed to ensure teachers are aware of the potential of technology-supported learning.

5. It needs to promote curricular change, shifting the focus from knowledge as a set of content to knowledge as an integration of processes and skills. The changing global context due to the impact of ICT is redefining the type of literacy and skills that are needed.
6. It needs to promote several actions from the government to establish the ITC educational networks e.g. training based on planning and reflection on classroom practice and potential new practice, including a reflection of their own roles as teachers and of learners' roles.
7. It needs to encourage the teachers to develop the use of ITC/VTR in their professional development.

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