Teaching Mathematics with Technology

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1. The Role of Teacher

It is known that teacher's role is to transfer knowledge to students. In schools a great deal of knowledge is taught to students. The history of the human race is very long, and out of this history a great poor of knowledge has been created. As a result, student must learn many things. The teacher aims to teach as much as possible to his/her students at school. It is very important that the poor of knowledge is transferred to the student by the teacher. In school the teacher believes in the efficiency of the education system. The teacher gives many knowledge to the student. This flow of knowledge is from teacher to student, and not the other way round. There is not the flow from the student to the teacher . In school there is no change in this flow of knowledge. The teacher always passes on knowledge to student, and the student acquiesce it from the teacher only.

We now hold doubts about this flow of knowledge in school. It is doubtful that the role of the teacher is to transfer knowledge to student. This fixed inflexibility is not good. It is desirable that the student relearns a great deal knowledge with the teacher. The work of the teacher is not to give knowledge to student. If his /her work entails learning with the student, the role of the teacher must change in order to help the student. A flexible approach to teaching is the style of future. At present, students dislike as a subject mathematics in school. We wish to change the current method of education.

But now we have developed a new technology which will benefit to education in school and home. For the student the educational helper is the teacher and the new technology. In the information-oriented society this technology is useful for education. The student learns everything through using new technology in the school. The teacher must not be left this work leaving their work in the charge of technology. The role of the teacher must change from only teaching to helping the students learning process. The role of the teacher is not teaching only, it is the help to student. And both the teacher and the student are the learner of the knowledge together in school. Our aim is for knowledge to be transferred to the student from the teacher in using technology . It is important for students that education is relearning with using this new technology, no teaching only and giving them by the teacher. But the role of the teacher is more important to the learning student with technology. We want the students experience in school to be an interesting and rewarding one. So using technology in school we think that the role of teacher is change to learn from to teach. It is important to make the new role of teacher at using technology. The system of the school change every part. The role of teacher is not giving the knowledge to student. It is the creating idea of student who is many

possibility.

We show the new style of lessons with new technology. We can understand the role of teacher in the lesson. Our mathematical education is the method of problems solving system. The teacher does not teach anything in the lessons, and the student tries to create the solution of mathematical problems. So in this lesson the student is the leading actor.

We divide the teaching method with three steps,

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Step 1:    Group activity
Step 2:    Presentation/discussion with  reports
Step 3:    Class to solve problems together
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This technology can be used in every subject. The student and the teacher can learn the every subject with this technology. This education involves both the teacher and the student. In this class room it is not silent at all time in the lesson. The teacher is waiting only for a long time. If the student can not understand the mean of the problem, the teacher helps to this student. We think that it is very difficult for the teacher to wait in the lessons. The role of teacher is waiting, no teaching in the lesson. For the student it is important to explore and to be creative with knowledge. We think that the new role is made by the new technology and the student.

2. Change of Teaching in the Classroom

We think that there are a number of styles of schooling education in the world. If we have our culture, the education form is difficult. When I went to the conference at USA, there is no desk in this conference room. It is not facilities to write the note. But there is no one who was writing anything on the notebook. American style and Japanese are different. We show the three styles.

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(1) the Visual type - Japanese Case
(2) the Auditory type - American Case
(3) the Body type - Using New Technology Case
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The American style is important to the sense of hearing. So their class lesson is are based on dialogue. The teacher aims to talk every time. The students do not write in their notebooks, he/she wants to hear everything. So the teacher uses the OHP (overhead projector). They do not use the desk. This style is the Auditory type. In Japanese case, the Visual type is using the writing. The blackboard is a useful tool for teacher and the student. Student wants to write in their notebooks, and the teacher also writes on the blackboard. In the Japanese style the OHP is not useful, it is not easy to write on them. So the class room is very silent, with no talking to each other. The two types- the Visual type and the Auditory type- are the representative types.

And now we show the new type of the education with the technology. This type is using every sense. What is the body type with technology? What does the teacher teach mathematics with technology? What is doing that the every sense use in the

lesson? You have many questions to the body type case. The student is teaching in the class room. We want that the student learn at going to out door. They learn every thing using the field work. Now the student use textbooks. They get the many knowledge from books. The body type lessons is all sense - visual sense, auditory sense and others. We want that they get the knowledge from nature and society. We have the laboratory in the school. It is most important place to study every subjects in the school. We want to build up the mathematical laboratory. The student use this laboratory and make new mathematical theorems. And more, we think that the system of the school lessons has the big wall. This wall is separating class rooms, and other wall is making the parts of subjects that is mathematics, science, chemistry and many parts. We want to break these walls in the school. So the new style of lessons is using the body sense. We can use every sense in the lesson.

3. New Method for Teaching Mathematics

We will show the role of the teacher and the style of teaching at school. With this technology we have a new style class room. We expect that the students will enjoy the mathematical teaching, and create new theorems in their lesson. Mathematical thinking is very difficult and we focus on the creativity necessary to make small theorems. Before we gave mathematical knowledge to the student. But now we change mathematical education using this new technology. The teacher does not teach anything in the class room. The student tries to discover mathematical knowledge with the aid of this technology. Before many students disliked mathematics, when they left school. The teacher does not simply teach knowledge but he/she discover helps the student to discover. The students have a natural mathematical creativity which the teacher can not discover. The student creates interesting theorems in the class room. We did not know that students have such mathematical creativity. The teacher does not teach the theorem, the student finds out theorems. And for themselves creating mathematical knowledge is interesting for the student. The students are actively unsolved the creating theorems. The student have a good time, and gain confidence in the mathematics.

With this new technology for mathematics lessons the force of this technology is to change the role of the teacher and the method of mathematical education. We have a new teaching style with this technology. This new method is to create and discover knowledge, not teach it to the student. In the lesson the student came to the lesson mathematics no mathematical knowledge learns mathematics with this technology. Before we thought that the student did not have anything, and could not create new theorems in the class room. To provide knowledge is easy for the teacher, because the teacher has a lot of knowledge. The student is only given unknown knowledge. This change in mathematics lessons is good for the student and the teacher. We think everyone likes mathematics. If the teacher does not teach mathematics to the student, the student learns more and more and gain more knowledge.

With technology mathematical textbooks change these writing style. We have the flow from the axiomatic matter to the test on all mathematical textbooks. It is very efficiencies to teach mathematics in the lesson. The well known theorems is written

by this flow (the left flow of the table). This flow is thought no using technology. We sue the flow in the mathematical education. Now we can use the new technology. So the style of the writing is also change. The main of the new style is the exploring and making the hypothesis from data. The mathematical education is changed from teaching by the teacher to exploring by the student. The new flow (the right flow of the table) is studying mathematics and other subjects with technology.
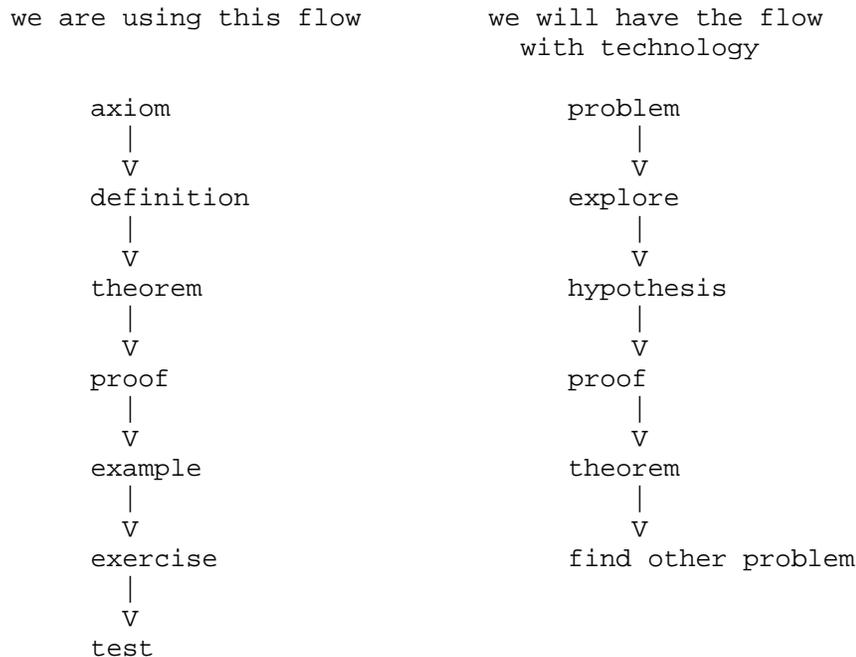
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    we are using this flow        we will have the flow
                                      with technology

            axiom                         problem
              |                              |
              V                              V
         definition                      explore
              |                              |
              V                              V
          theorem                        hypothesis
              |                              |
              V                              V
           proof                          proof
              |                              |
              V                              V
          example                        theorem
              |                              |
              V                              V
          exercise                     find other problem
              |
              V
           test
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Table : Two Flows of the Lesson

4. Examples of Teaching Mathematics with Technology

The following are examples of creating theorems in the mathematics room with technology. The teacher prepares the problem to the student. The student has no idea and no knowledge of how to solve the given problem, but they use technology. The approach and thinking to this given problem is different to the old thinking. Using technology, the student tries to trail and error. The trail and error for the given problem the student can find out the truth and the rule in this problem. The student can see and touch the mathematics and understand the mathematics easily.__

(1) The shortest path problem
The teacher knows these problems well; Fermat point of a triangle and Steiner networks. But the student does not have any mathematical knowledge. Previously, solutions to these problems were given the solution to the student. The student proved these truths. Now the student uses the software named Cabri Geometry and explores this geometry with enjoyment. They find many interesting things and want

to prove them. And they create new problems, for example points number 3 to 4,5,6. In school lessons the students use computers and they use TI-92 in after school lessons. They use some technology every time. The thinking of geometrical problem is good for exploring.

Fermat point of a triangle

Fermat challenged Torricelli to the point P, whose total sum of distances from the vertices of a triangle ABC is a minimum. Previously we showed to the student that the point P is the intersection of three cycles. But now we want to find out the point P with Cabri Geometry and TI-92. When the student studies this problem, it is very difficult to make these regular triangles. If they can find out the angle 120, they have the solution (Fig.1).
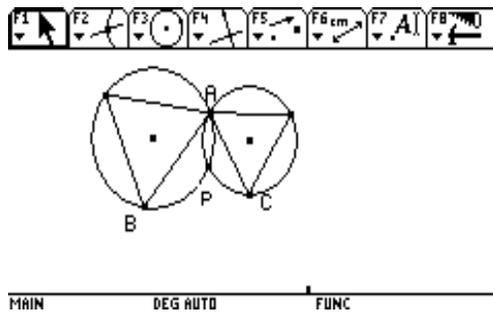
Fig.1 the solution to Fermat point of a triangle

Steiner networks

Steiner extended the problem of the Fermat point by considering four or more points and asking for the shortest route which connected all of them. We have the solution with points 4 (Fig.2). We know that these problems were taught to students by Mr. Arne Engebretsen (Greendate High School USA) in his high school mathematics class. His student studied with enjoyment. They had good solutions in which were mistakes.
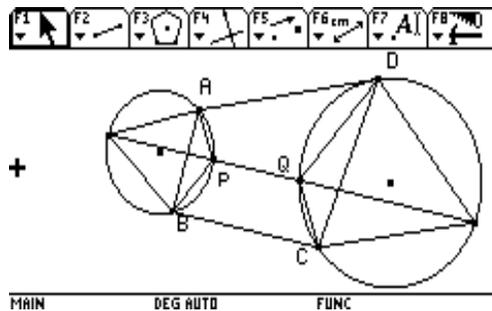
Fig.2 the solution to Steiner networks with points 4

(2) The shortest path problem (easier example with TI-92)

In the class we prove the Heron problem with TI-92. Heron proved that the angles of incidence and reflection at the surface of a mirror are equal. Reflect point B in the

mirror. The shortest distance AP+PB, P is on line l. Now we show that the point P moves on line l. In Fig.3 AP=0.98, PB=3.75 and R=AP+PB=4.73. If the point moves on the line, the number R changes. So we find the smallest number R. We get the solution of this problem. We can see the mathematics and experience of this problem. Now we have interesting mathematics for all students.
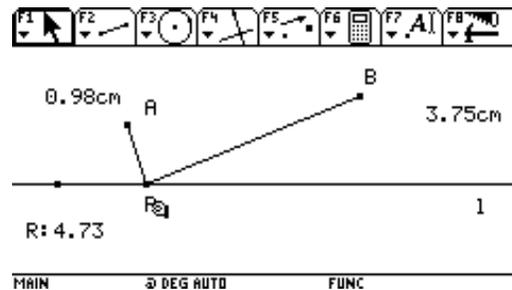

Fig.3 the Heron problem with TI-92

5. Enjoyment and Technology in the Mathematics

We show some changing styles of school education with technology. The main are the role of teacher, using many sense and textbook. More change is the attitude of the learning students. They are enjoy in the mathematical lessons. Without technology they are given the mathematical theorems by teacher and books. But now they study mathematics with exploring and creating method. This method is named the problem solving with technology. It is important to study mathematics with enjoy. The technology is changed the attitude of students. In future we use the technology in school lessons.

6. References

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Research shows that teachers can integrate technology to help students grasp mathematical procedures and develop advanced mathematical proficiencies. The National Council of Teachers of Mathematics (NCTM) added that technological tools are necessary for engaging students. What types of technology can be implemented into mathematics classrooms? The following section offers several ideas that can help when teaching math to kids. 8 Virtual Resources that Help Teach Mathematics. Here are some effective tools for teaching math with technology. 1. Desmos. Desmos offers a free web-based graphing calculator as well as digital activities for grades 6-12. The primary offering is a calculator that matches the functionality of many $100-plus TI calculators. Teaching Math Using Technology. The following posting is written by David Moss. David was an elementary teacher who is working on his master's degree in mathematics education. He is interested in finding ways to effectively support students to learn math by integrating technology. (Note- Scroll down to bottom of the page for additional links and resources). Technology is becoming more prominent in today's classrooms. Students use computers, tablets, and smart boards while learning. In mathematics, these tools can be very useful for teachers in engaging students with new material and lessons. Online websites offer teachers a variety of lesson plans and virtual manipulatives. With so many options though, it is hard to find the good sites that teachers can use. Technology can change the nature of school mathematics by engaging students in more active mathematical practices such as experimenting, investigating and problem solving that bring depth to their learning and encourage them to ask questions rather than only looking for answers (Farrell, 1996; Makar & Confrey, 2006). • the subject (using technology to support new goals or teaching methods for a mathematics course). Snapshots of classroom mathematical practice. Two snapshots are presented here to illustrate how technology can be used creatively to support new mathematical practices. Teaching with technology is not an easy task! Several investigations have been carried out on the. technology integration in the teaching/learning process and repeatedly concluded that the methodologies used should. be rethought, not occurring improvements in educational attainment, teachers were not comfortable with the use of. learning Mathematics with an appropriate technology. 3. Adapting (decision), where teachers engage in activities that lead to a choice to adopt or reject teaching. and learning Mathematics with an appropriate technology. 4. Exploring (implementation), where teachers actively integrate teaching and learning of Mathematics with. an appropriate technology.