Chapter 3-5c

DISTANCE LEARNING BETWEEN JAPANESE AND GERMAN CLASSROOMS

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1. BACKGROUND FOR THE PROJECT

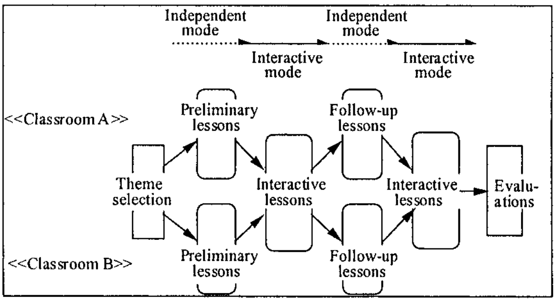
There were different observations about new objectives of education at the beginning of the work on our joint projects of distance learning between remote classrooms: the research group of Kiyoshi Yokochi in Japan was concerned with the growing demand for an improvement of the quality of mathematics education (Yokochi 1995), whereas Klaus-D. Graf was more concerned with reflecting general intentions of education like inter-disciplinary and intercultural context, which should be integrated in all subjects' education, and had sketched models for this purpose (Graf 1995, referring to Ruiz 1993). Yokochi's and Seiji Moriya's activities with classes from different Japanese districts had shown that this method of remote distance learning provided considerable profit for the intentions mentioned.

When exchanging these observations, we agreed that in Japan and in Germany, as well as in other countries, there are challenges to societies by universal problems such as the world economy or environment, which require immense international interaction. Any success is dependent on mutual understanding and acknowledgement of different traditions and attitudes related to such problems. Readiness and good will have to be developed in young people growing into these societies.

So we decided to start a series of international and intercultural distance learning experiments in mathematics education with these aims:

(1) Initiating mathematical originality and creativity of pupils and students
(2) Learning comprehensive uses of mathematics with other subjects through solving real problems
(3) Improving the mathematical scholarship of students
(4) Appreciating and acknowledging the mathematical cultural characteristics of each district or country in problem solving
(5) Cultural exchanges related to science and technology between students of two classes
(6) Interaction with peers from different districts or countries in mathematical problem solving, complicated by constraints like different languages, for example.

2. BASIC STRUCTURE OF THE LEARNING AND TEACHING EXPERIMENTS



Each experiment consisted of different activities of two partner school classes and their teachers, together with researchers in didactics at universities, extending over six to twelve weeks. The activities started with preparation of a project by researchers and teachers, contacts running via mutual visits in Germany and Japan or via e-mail, Internet homepages or airmail. After this, teachers in the two countries started working with their classes concurrently on the same topic, mostly taken from mathematics, science, social science (environmental problems) or arts.

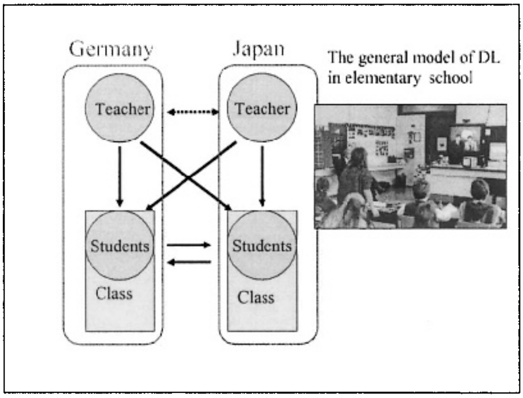
Besides learning about the topic in different ways the students, in more or less cooperation with their teachers, started to prepare demonstrations for their peers about the problems given to them, their findings and results. These demonstrations, followed by interaction between the students, were executed in several video conferences integrated into the total activity of 6 – 12 weeks. Material was also forwarded by e-mail or fax or put in the respective homepages on the Internet.

In the primary schools, some videoconferences consisted of teaching by the foreign teachers about the mathematical background of some products generated (for example, tiles with patterns) to the other class, allowing questions and answers.

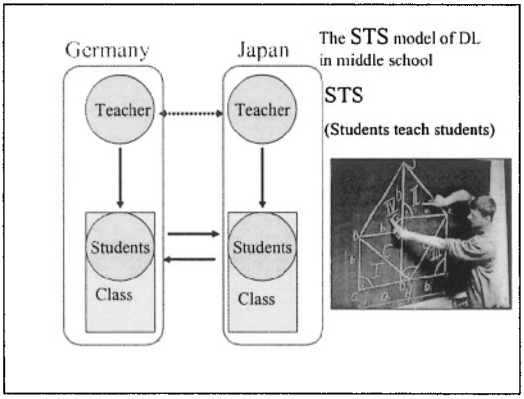
In secondary schools, the teaching was done by the students themselves, followed by demonstrations and discussions.

In addition to concentrating on special subject matter, which was essential in our design of the learning units, there were passages in the activities, per e-mail or in the video conferences, where the students tried to find out more personal information about each other, concerning pets, grading systems, views on the other countries or people, including the students themselves.

At the end of each conference there was a detailed discussion of teachers and teacher educators, as well as administrators, about their impressions and observations.



The general model



The STS model

3. AGE LEVELS AND CONTENT OF EXPERIMENT

The following partnerships and learning units between German and Japanese classes or Japanese and Chinese classes have been realised so far:

a) Peter-Witte-Primary-School in Berlin and a Primary School attached to Yamanashi University in Kofu. The students came from grades 5 and 6; there were 20 in Berlin and 40 in Kofu. Their subject matter was stripe patterns and rectangular patterns, seen under aspects of mathematics and art. There were four video conferences of one hour each included, two dominated by students' presentations and discussions, two by teaching of the teachers to remote classes. Two German teachers performed team-teaching for some periods.

b) Hildegard-Wegscheider-Secondary-School in Berlin and Irihirose High School in Niigata. The students came from grade 10 in Berlin and grades 8 and 9 in Japan. Subject matter was the Theorem of Pythagoras. Groups of German students explained proofs at different levels: experimental work, visualisation by graphics and logical proof based on constructions at the blackboard. There was one video conference of about 75 minutes.

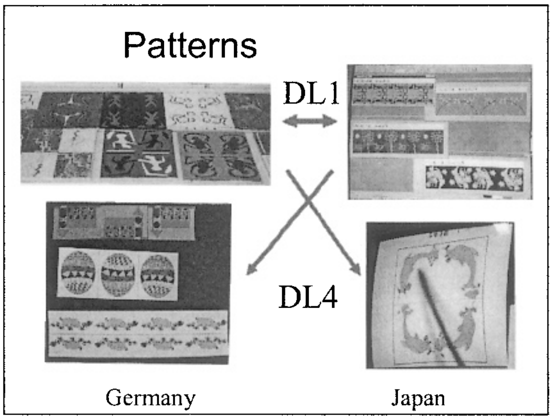
c) Hildegard-Wegscheider-Secondary-School in Berlin and a Secondary School attached to Yamagata University in Yamagata. The students came from grade 10 in Berlin and grade 9 in Japan. Subject matter was the sundial and its mathematical background from the geometry of the globe. As in b) groups of Japanese students taught the German students using models and logical explanations at the blackboard. They put forward excellent questions to the German students and they showed great excitement about good answers.

There was one video conference of about 75 minutes.

Three more experiments took place between students from 3 different upper secondary schools in Tokyo and 3 in Berlin, centred around environmental problems, which shall not be discussed here in detail. In addition, we executed a couple of video conferences between Berlin teacher students in computer science education and Kyoto teacher students in mathematics education, with interaction about fascinating applications from history and real environments in classes.

4. METHODS OF TEACHING, LEARNING AND INTERACTION

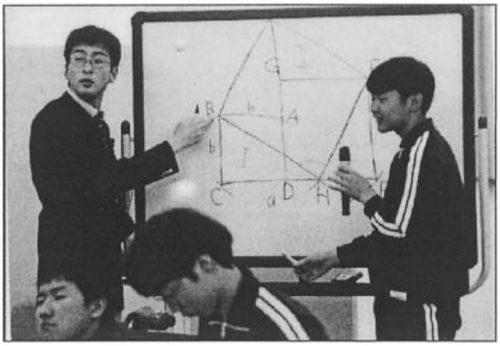
Different methods were applied and experienced. In the primary school experiments both sides followed a rather conservative mode of teachers on both sides controlling the performance of the classes and asking most of the questions. The pupils were given opportunities to present their work with prepared statements. Students and teachers spoke in their mother tongues; they were translated by interpreters in both classrooms. All students showed great patience when waiting for translations for the other side.



The change of motives (4)

Product table (3)

The Pythagoras experiment was characterised by independent teaching of German groups of students to the other side. They had explored the topic on the Internet and evaluated the results together with their teacher. The effect of learning was considerable on both sides, since there was a high motivation towards good teaching and understanding. This experiment was also characterised by both classes speaking English. This caused many misunderstandings and repetitions. Using figures and visualisations helped relieve this situation.



proving Pythagoras theorem (1)

explaining the principle of the sundial (1)

The sundial experiment was also conducted in English with the Japanese students doing most of the teaching in small groups. This was an outstanding event in a Japanese classroom. The Japanese students had prepared excellent material for the visualisation of shadows depending on the sun-earth constellations.

In the Berlin-Tokyo experiments there was a special situation in language, since all of the German students had taken Japanese language courses in their schools. So they had prepared their statements in Japanese, including a popular Japanese song, which was happily accepted by their peers in Japan. Japanese students gave their contributions in their own language and the Germans tried to understand. Interpreters in both classrooms translated, if necessary.

We would like to add a general remark here about the role of teachers in our special learning setting. We started our experiments with teachers organising most of the planning and the execution of work in classes. The students' roles were mostly to demonstrate what they had learned. Elder students then took over some of the teaching. This was still organised or "filtered" by the teachers. With growing experience, the students' demand grew to erase the filters totally, including the activities of preparing to teach and so to replace their own learning by preparing to teach. This of course, causes a gain in active learning, but at the same time a loss in efficient learning.

5. FINDINGS FOR GENERAL AND SUBJECT MATTER EDUCATION

It should be mentioned that our experiments did not only affect the learning and understanding of the students. At the same time the researchers from teacher education as well as the teachers active in preparation, execution, and evaluation of the distance learning experiments profited a lot. They had to reflect deeply on the educational theories they were relying on, so that they would be understood by the partners in the other country. Considerable feedback had to be given to make sure that the others' intentions had been understood. It became clear that understanding went far beyond the language problems. Still, using English to explain activities based on German or Japanese language was a problem in itself. The teachers had extra work to invest since they had to explain their project in their environment, for example to colleagues, school administrators and parents. They experienced that both sides were very ambitious to 'perform' good presentations and they had to control these tendencies for the sake of allowing genuine learning processes.

Comparing the teachers' styles, one point especially became apparent: There was a strong tendency with Japanese teachers to prepare each video conference very carefully, leaving no space for unexpected or unsolvable situations and thus guaranteeing an effective and efficient learning success. They were very interested to arrange with German teachers for a common "scenario" before the video conferences. German teachers, on the other hand, were ready for a more open proceeding, allowing mistakes by students for example, and thus a less efficient course of the conferences.

Japanese teachers experienced that for the experiments they needed knowledge from astronomy, history, art and language for this kind of mathematics education. In their teacher education at universities they had not learnt such subject matter, whereas German teachers have education in at least two subjects.

It is, of course, not possible to verify precisely to what extent the aims mentioned in section 1 could be fulfilled. Many of the observations we made relate to several aims, others bring in new aspects. Here are some of our findings.

1. Before the experiments in Peter-Witte-Elementary School, German students as well as teachers were not aware of the abundance of geometrical patterns around them. In the course of the video conferences real mathematical originality and creativity was displayed by all students when finding such examples in their environments for the different kinds of patterns they had to deal with, and even more when they applied patterns to decorate real objects like tiles or T-shirts. German students had no problems in finding these examples in their city environment, whereas Japanese students tended to look for traditional patterns in books or similar sources. Japanese secondary students did remarkable work when creating adequate models for sundials and for demonstrating sun-earth constellations, while their German peers were very capable in finding intuitive methods to exemplify Pythagoras' theorem before turning to a precise logical proof. After the experiments many students confirmed the following attitude as adequate: "If it is difficult to solve a problem in the usual way, then I think of another way".

2. Related to the Theorem of Pythagoras, Japanese teachers stated that their German colleagues think the Theorem's history and value as important as the pure formula, whereas they themselves turn to application very soon and let the students do many practical exercises. Comprehensive uses of mathematics were successfully realised in relation to arts, when classifying stripe or rectangular patterns. After a formal geometry lesson on symmetries in a video conference Japanese students expressed their feeling now that mathematics is a language which can be used all over the world. The application oriented kind of problems posed generated high motivation in all students.

3. The experiment offered many opportunities to further the students' mathematical scholarship, when tools like group tables were introduced or elements from spherical trigonometry were taught. Evidence for this became clear when they could easily find all possible patterns in squares or in equilateral triangles and even completed the corresponding group tables. The problem "draw a figure formed by the symmetry on a slanting (diagonal) line" was solved by 29% of Japanese students before the experiment and 71% after.

4. Appreciation and acknowledgement of cultural characteristics could be well observed. German students were really fascinated by the Japanese students' abilities in decorative art, which led them to mathematical questions; Japanese students were impressed, and some of them even intimidated by the German way of dealing with mathematical problems that were 'pure' or abstract, without a 'real', concrete problem. When looking for basic elements for their rectangular patterns German students in the beginning chose abstract motifs, which they had dealt with in art education (Paul Klee, for example). Japanese students selected rather traditional and real motifs like kites, fans, cherry trees, fireworks, etc for their stripe patterns. After demonstrating their works to each other, and after having learnt from the teachers how to generate these patterns, they changed the type of motifs. In the following demonstration Japanese students presented rectangular patterns with abstract motifs on T-shirts and German students showed up with stripe patterns on place mats, with motifs like a church or the Brandenburg Gate. Interesting discussions occurred about the reasons for selecting special combinations of colour, or when the students discovered that they were using different kinds of geometric tools.

5. Numerous and interesting observations could be made on cultural exchanges. Fr example, a comparison of grading systems was performed with deep interest on both sides. A rather surprising reaction happened when, in a conversation about pets, a Japanese girl really shocked the German students by showing her squirrel in a cage. This is absolutely unusual in Germany. In one experiment students were asking each other, which were their impressions and ideas about the other country. It turned out that there still exist many cut and dried opinions, which often seem incredible to the other side. One example: a Japanese student thinks Germany is a very clean country and those who litter will be put in jail.

6. Interaction with peers again allowed many fascinating and encouraging observations. There was a continuous zeal to report things to the foreign

peers as well as to listen and to understand them. This was accompanied by a remarkable patience, when they had to wait for an interpretation or when they had to ask again because of problems with English language. There was a clear atmosphere of competing, but in a friendly way. Secondary students in particular did not hesitate to express their appreciation for good explanations or demonstrations. Germans did this with a 'cool' attitude, while Japanese students expressed their acknowledgement more enthusiastically and cheered after good answers to questions they put. In all experiments students and teachers, as well as observers, expressed their feeling of an intimate closeness in the course of the video conferences. Due to large screens on both sides, the two classrooms seemed really close together.

7. To end this section a few more general observations shall underline the very positive atmosphere created through the experiments and appreciated by all participants. The students' great interest in each project was sustained for the whole period, despite the extra efforts they had to take. There were no drop outs at all. The students were planning with great zeal how to explain their results to their peers in the other country. They developed a very general interest in the other environment and country. They discussed their project with other students and teachers from their schools, and with their parents and families. Without problems in using the new technology they put direct questions to their peers in the other countries, forgetting about the distance.

6. CONCLUSIONS AND VISIONS

Neither the cost of the equipment and communication nor the extra amount of work related to the new media for distance learning should discourage us from integrating these media into the teaching and learning processes. This situation is comparable to the days when computers first entered schools and appeared uneconomical and unusable for education.

Teleconferencing systems, or what will be developed from them, will be a standard medium in schools within a few years. They will not only be used for communication with peers, which we consider a very fruitful application, but also for communication with any point on the globe and anybody on the globe who can contribute to the demands of students to get information in an interactive way. Teachers will have to become advisors and supervisors for this learning by exploring. They have to prevent students from wasting too much time by unstructured exploring.

Distance learning has originated from the problem of physical distance in time and/or space between a class and a teacher, or, more generally, between learners and knowledge bases including intelligence to interact – real or artificial. The more this intelligence and its means to interact (through multimedia) grow, the less the physical distance will matter. Instead, cultural distance as we used it in our experiments will become important for the learning process between learners and an intelligent source of knowledge. This distance can cause the learners to get more stimulated to learn from a distant source, be it a group of peers or a knowledge base, to learn more through competing, or just through imitation and variation.

Putting individuals into school classes for learning may have economical reasons. But – each student coming from a different environment (the culture of a family, for example) – it also means to initiate some kind of distance learning. This idea can be extended to the family of man.

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