Professional Development Needs of Teachers Managing Self-Guided Learning

Wolfgang Weber
Department of Information, Documentation and Communication, State Institute for Schools, Paradieser Weg 64, D-59494 Soest, Germany, wolfgang.weber@mail.lsw.nrw.de

Abstract: In the project 'Self-guided Learning in Teaching Mathematics at Senior High School Level' (SelMa), five authoring schools are working out scenarios, media and materials for phases of self-guided learning, which will be tested systematically by 10 trial schools with regard to their everyday suitability. In this paper three approaches to such learning arrangements (independent learning centre, jigsaw classroom and learning at stations) are being outlined and relevant experiences are being made available. Learning diaries prove to be useful for the learners' reflections on their learning processes. The adaptation of such learning arrangements and media to a specific learning group does place new demands on the teachers. In addition, diagnosing and consulting in connection with the individual learning processes require new, or enhanced competencies on the part of the teachers who, in spite of having made available more freedom within the framework of teaching, still cannot make adequate use of their enhanced role. Possibilities for further development are outlined.

1. GENERAL INFORMATION

The four-year (1999-2003) pilot project 'Self-guided Learning in Teaching Mathematics at Senior High School Level' (SelMa) is funded by the federal government and by the state of North-Rhine-Westphalia. SelMa is monitored by the LfS (State Institute for Schools). The aim of this pilot project is to show what teaching mathematics at senior high school level can look like if self-guided learning and activities are supported by the use of new media. Special importance is placed on integrating aspects of self-guided learning in everyday teaching. Learning, mathematics and the use of new media - these are the pillars on which SelMa stands. Special emphasis is

The original version of this chapter was revised: The copyright line was incorrect. This has been corrected. The Erratum to this chapter is available at DOI: 10.1007/978-0-387-35701-0_35
C. Dowling et al. (eds.), *Information and Communication Technology and the Teacher of the Future*

placed on the delivery of the new curriculum for mathematics, which focuses upon aspects of self-guided learning and must be integrated into everyday school life. The purpose of SelMa is to give teachers orientation and ideas for their own teaching. Scenarios and materials for self-guided learning phases in teaching mathematics at senior high school level are being developed in five 'authoring schools'. These learning arrangements are accessible for teachers for trial purposes on the North-Rhine-Westphalian web-site 'learn:line' (http://www.mathe-selma.de). This website provides an information, communication and co-operation environment for this purpose. Learn:line encourages the exchange of information and experiences between teachers. The development of materials by the authoring schools is to take place in an 'open workshop', so that other schools can also try out them at an early stage and regularly report on their own experiences. A special role is played by ten 'trial schools' that systematically try out and evaluate the materials that have been developed to see whether they work in everyday usage. Their feedback will be incorporated in the on-going development of materials. Furthermore, authoring and trial schools are to disseminate their practice so that networks of schools can be created in the different regions and the materials on learn:line can be further developed. In this way the scenarios will be used in an increasing number of schools. Publishers are to be included at an early stage. This is expected to lead to higher-quality (offline and online) media that will support phases of self-guided learning in teaching mathematics. The SelMa project is being evaluated by the Institute for School Development Research, University of Dortmund.

2. OUR VISION OF AN INDEPENDENT LEARNER

Independent learners are able to determine their own targets and are accordingly able to choose the topics for their own learning projects. In school it is therefore of importance to them to be involved already in the planning and structuring of lessons. In order to reach their goals the students have at their disposal sufficient self-motivation, which spurs them on in learning and working. They are not dependent on external motivation. They actively contribute to the learning processes. Self-generated activity is another one of their characteristics. The passive receptive role of a learner is alien to them. They understand how to plan their work in proportion to the problem, to structure, organize and carry it out in a time-effective way. In addition to all this they can fall back upon a wide repertoire of methodical know-how. Thus they are able to investigate in a result-oriented way, to select, structure and evaluate the information obtained in order to construct new knowledge of their own, which is tied to the knowledge already at hand,

starting a networking process. Their pronounced media competence assists them in making use of both traditional as well as new media for the purpose of their own learning processes. Independent learners are able to clearly and appealingly document what has been learned and are able to process it in such a way that they can present it to others, using reasoned argument to advocate it. Regarding learning situations at school, the teacher is for them a supporter, advisor, coach or even supervisor - who is addressed by them if required or consulted in the case of learning problems.

In addition to the original goals and work, independent learners at the same time have an eye on their own learning processes. They document their own ways of learning thus making them available for their own evaluation or reflection – or for a joint one together with the teacher. This process of becoming aware of their own learning helps them to abstract from the actual learning situation and to gain insight into the transfer to other learning situations – thus further developing their 'learning training'. Based on this background they are also able to realistically assess their own learning performance as well as communicating it, for example to their teachers.

Independent learners additionally bring their communicative and social competencies, their willingness to co-operate and their team spirit to bear in group-relevant self-learning processes. Namely, they must succeed in coming to an understanding with the other learners inside the group about mutual goals, work plans and, for example, criteria for quality assessment with regard to the output yielded. In the case of actions based on 'job-sharing', the working and learning processes have to be co-ordinated with each other and the partial results so gained have to be applied or be brought together. In particular, the handling of stress or conflict situations requires a social competence, which is quite well developed. In relation to group learning processes, the evaluation has to be handled similarly and in addition to the reflection on the personal learning process. Added to the student's responsibility for the personal learning process is a share of responsibility for the learning process of the group's members.

3. THE PROJECT REALITY

At the start of the project the participating teachers found themselves facing the following situation: the majority of those learners with whom the project work is being done are from secondary level I, and mainly familiar with traditional teaching methods focussing on the teacher. With regard to teaching mathematics most of them tend to have little motivation, they are rather passive, receptive and fixated on the reproduction of knowledge or

information instead of being geared to their own activity. Most of the teachers lack media and methodological competence – especially with regard to the new media. For many learners it is a particular novelty to render their own learning process into the subject of contemplation. Based on such a background, independent learning can only be striven for as a fairly long-term target. Many intermediate steps are necessary and it is consequently very time-consuming to develop the necessary competences.

4. DEVELOPMENT OF SCENARIOS AND MATERIALS

Different scenarios (learning arrangements) and materials for independent learning are being developed and tested in SelMa, with different facets of independent learning being the centre of attention. Each and every approach is geared to approaching closer to the ideal of independent learning. Three approaches are outlined here.

4.1 The independent learning centre

Learning in the independent learning centre distinguishes itself quite radically from the other scenarios described herein, insofar as with this approach the learners have no choice but to fend for themselves. In a kind of media centre a variety of traditional and new media are at their disposal - but the teachers, who normally accompany the learning processes, are missing.

The work of this SelMa authoring team is closely related to further developments in their school. In an independent learning centre, pupils work on their own, on mathematical topics specified in the curriculum for Years 11 and 12. The material that is prepared for the independent learning centre consists of courses on the one hand and of collections of problems on the other. Graded aids for learning relating to the pupils' existing knowledge provide both food for thought and initial approaches towards solving the problems. Suggested solutions to the problems allow the learners to check the progress they are making. The computer provides opportunities for simulation and visualisation of mathematics. Pupils normally meet in groups of two or three in the independent learning centre and discuss individual problems. The aim is for the individual pupil to establish as precisely as possible those areas where practice is most necessary.

4.2 The jigsaw puzzle classroom

Another group of authors tackled in particular the question of how self-directed activity of learners inside the classroom can be furthered. While searching for such scenarios, which depart from teacher-focussed teaching in order to reach forms of teaching, where at any given time several or even many learners can be simultaneously active, they came across the so-called jigsaw classroom.

It appears that for this scenario a substantial part of the teacher's work is based on preparation. He or she divides a larger topic into several (usually 4-6) sub-topics. For each sub-topic materials for self-learning, which are designed in such a way that they can be handled by the learners individually within a given timeframe, are provided. With regard to its sequence, the jigsaw classroom is comparatively strictly organized. It is divided into:

- Introduction, organization of the work;
- Phase 1: Individual work with the materials for self-study;
- Phase 2: Experts' round;
- Phase 3: Exchange round (learning by teaching);
- Retrospective, reflection of the learning process.

In the phase for individual work, the learners exploit the relevant sub-topic as much as they are able to on an individual basis, with the aid of the materials for self-study. Then all those learners, who have tackled the same sub-topic, meet in a group, the so-called experts' round. Here they settle pending questions, discuss their findings and thus jointly become experts for their sub-topic. In this phase they also prepare jointly how they will pass on the newly acquired knowledge to their fellow learners in the next round.

For the next phase the groups will be re-shuffled like in a jigsaw puzzle, so that experts for each and every one of the sub-topics come together at one group table. The learners introduce the various sub-topics, discuss them jointly and thus handle the whole of the topic in the group.

4.3 Learning stations

In this scenario, having pupils study materials at different learning stations particularly supports individual learning. The complete learning circle consists of several (about 20) stations, which are assigned to several thematic areas. The stations are set up in such a way that different background levels of learning, different speeds of learning and working, and different needs in terms of working individually, in pairs or in groups are accommodated. There are compulsory and optional stations. Thus the learners are enabled, if only within a limited framework, to influence the

selection of learning content. To help pupils find their way they are given a 'docket', which lists all the stations (number; title; topic; compulsory or additional station; individual, pair or group work). The 'docket' also contains hints as to which aspects might be of significance with regard to the selection decision.

5. LEARNING DIARIES

In all scenarios it is central to the teachers' intention that the learners also focus on their own learning process - even if this is quite unusual for most of them. At the beginning this is done by rather small surveying tasks, which offer the opportunity for discussion. During the course of events more and more aspects are added. Everything works towards demonstrating to the learner the advantages of keeping an individual learning diary. Compared with the team-related learning diary, this type has demonstrated two strengths. On the one hand, pupils continuously reflect on their progress in terms of the subject matter, and on the other hand, this method allows very personal diary entries about the pupil's progress in learning - provided only the teacher reads the learning diary.

6. INSIGHTS AND EXPERIENCES

6.1 The independent learning centre

In the case of the independent learning centre the media used for working by the learners, mostly on an individual or partner-oriented basis, play a key role. When designing such media, it is necessary to balance an openness that permits independent learning and working against a more compelling degree of control that does not leave the learners to cope with their problems single-handed. Special attention must therefore be paid to the help systems, which are integrated into the media. It is extremely time and energy consuming to develop such context-sensitive aids to cover the individual learning situation. This has been successfully mastered in the case of well-defined courses, but becomes more and more complex the more open the learning situation is being designed.

With regard to the learners, working in such an independent learning centre demands well-developed competencies and places high demands on their self-discipline. The longer the phases of individual learning last, the higher are the demands on planning, structuring and organization of their

own learning process. Weaker pupils in particular tend to bring in the aids integrated into the media much too early and in a far too intensive manner.

6.2 The jigsaw puzzle classroom

The jigsaw puzzle classroom is reacted to with a high degree of acceptance both by the learning and the teaching parties. This is probably due to the fact that during the different phases all learners are firmly integrated into the learning processes. Students and teachers experience the exposure to the prevailing topic as being very intensive. The jigsaw classroom supports co-operative work within a group of learners. Quite evidently the jigsaw classroom can strengthen the self-confidence of the otherwise rather quiet or weaker students. The jigsaw classroom may also lead towards a perceptively higher esteem for each other among the learners.

In the case of good preparation, the teacher has completed a "substantial part of his work", when the jigsaw classroom actually begins. The clear structure of the jigsaw classroom enables the teacher to almost completely withdraw from the teaching process while the jigsaw classroom is executed as such. Should the need arise, he is required in the process of group formation, in case or organizational questions and for time control. By withdrawing from the teaching process, a new kind of freedom is created for the teachers. To make use of this freedom in favour of new tasks (e.g. diagnose, consulting) opens up great opportunities.

6.3 Learning stations

According to the concept of learning stations the students first of all have to complete their compulsory tasks in the different sections. Due to the optional tasks they themselves may, within a certain framework, influence the choice of topics and also of goals. Better performing students in particular are very appropriately accommodated by the possibilities offered here. Weaker students, however, are easily and very often challenged too much by the sheer range of decisions demanded from them. They become rather unsettled and seem to feel that they miss out on important things.

Again with learning stations the question of making available adequate aids or solutions arises. In the opinion of many teachers, access made too easy entices the learners to leave their own path of learning too hastily. They therefore suggest planning the aids in areas outside the stations and preferably having access monitored by the teacher.

It is remarkable that the learning stations are rarely adopted by the trial schools in a 1:1 ratio. Teachers are using the possibilities to add to the

stations their own, already proven tasks, and to make do without those tasks which they consider to be less suitable or rather too difficult. It can be observed that, in the case of such adaptations, the number of options made available to the students is considerably reduced and that thus the degree of reliability is clearly increased. As with the jigsaw classroom most teachers also succeed here in withdrawing themselves to a significant extent from the teaching process. Also here the newly emerging freedom can be seized to a greater extent as a new opportunity.

6.4 Learning diaries

Experiences have shown that the keeping of a learning diary has a permanent and positive effect on the learning process in mathematics at senior high school level if pupils accept this method. The pupils clearly pay more attention to the learning process, try to answer questions immediately (rather than waiting until the last possible minute before the test), and are far more aware of their own strengths and weaknesses when studying mathematics. The personal learning diary encourages pupils to reflect more on their own learning strategies. Without exception, pupils who had been using this method for some time gradually displayed more stable and better performance in mathematics compared to that at the beginning of the school year. The learning diary supports comprehending and solving mathematical problems. It increases medium and long-term retention and can relatively easily be incorporated into normal everyday teaching. But very often it takes the students a lot of will power to approach the teacher as a consultant. Only the strict and clear differentiation between consulting and assessing creates the atmosphere of trust required and enables sustainable behavioural changes. Methodical knowledge in the areas of meta cognition and reflection on learning processes proves to be particularly helpful for the teachers with regard to the stimulation of relevant competencies in the students. Through the learning diaries the teachers additionally gain an important tool for reflection on their own teaching.

7. NEW DEMANDS ON THE TEACHERS

At the transition point to self-guided learning, the process of learning and the learners themselves are at the very centre of all observations. Which individual dispositions have to be taken into consideration, which previously gained knowledge and which previous experience can be used as a base, which expectations pupils have with regard to topics and classroom teaching

and which goals they have when they tackle the syllabus - all this is being analyzed to a much greater extent.

It is the teacher's responsibility to create the required basic conditions, to initiate the learning process, to motivate the learners and to consult and assist them with regard to their planning and the structuring of the learning process, their time-management, their account and back-up of the outcome of their work, their reflection and the evaluation of their own learning processes. The majority of teachers are inadequately prepared for this extended role. During the relevant teaching phases they often withdraw themselves too much, which results in the pupils feeling being left alone. In spite of the fact that teachers would now have time to diagnose the learning level, which would provide them with important clues with regard to consulting and assisting, for the most part they lack the necessary diagnostic repertoire. In addition, teachers perceive themselves as deficient with regard to competence in the fields of communication, presentation, methodology and media especially, all of which are important prerequisites for the core competence of designing adequate learning arrangements for the different phases of self-guided learning.

For this purpose, teachers must know how learners are working with such learning arrangements, in order to gain insight into didactic and methodological design. The compiling of materials for self-guided learning requires that the developers put themselves into the place of the learners and start thinking in the latters' categories of interests, learning prerequisites and expectations. This is the only way to create materials, which at a later stage can be exploited independently by the learners. During the conceptual stages of such learning arrangements, teachers notice quite often that they actually have only slight knowledge of their pupils' learning conditions. If insights into, for example, different types of learners and varying levels of performance, be they low or high, do exist, then the question still remains as to how all this has to be considered in the light of compiling materials and learning arrangements. Particularly in the case of non-homogeneous learning groups, discussions lead again and again to questions of the extent to which help systems are to be integrated into the materials, down to which level of detail they have to be implemented, and to what extent they may then support or even hamper self-guided learning.

8. FUTURE PROSPECTS

Phases of self-guided learning are, contrary to popular opinion, generally more strenuous and labour-intensive than preparing for and conducting

traditional teaching, and this is true for both the teacher as well as for the learner. Not least because of this, the learners demand again and again to allow equally for phases of traditional teaching. Also the fear that teachers might become superfluous during phases of self-learning is easy to disprove. Particularly during self-learning phases, teachers are challenged in their capacity as qualified experts and, much more than in traditional teaching, as sympathetic pedagogic consultants and experts for the optimization of individual learning processes.

Regarding their workload the teachers often (to their surprise) find out that their own familiarization with the mostly quite complex media associated with these self-learning phases is at times considerably and additionally time-consuming.

If the teachers really get involved in individualized consulting and accompanying of the learners' individual learning processes, then the time and energy used for this purpose during classes does increase considerably. Teachers can only do this in the long run, if learners are also willing in the future to take over additional tasks themselves. New and different methods of self-evaluation might possibly bring relief to the teachers if they display learning progress and learning obstacles to the learners, at the same time providing information that can serve as a basis for consultation between teachers and students.

REFERENCES

Landesinstitut für Schule und Weiterbildung. (2000). *Förderung selbständigen Lernens in der gymnasialen Oberstufe.* DruckVerlag Kettler, Bönen.

Mandl, H. Reinmann-Rothmeier, G. & Gräsel, C. (1998). Gutachten zum BLK-Programm: Systematische Einbeziehung von Medien, Informations- und Kommunikations-technologien (Forschungsbericht Nr. 93). Ludwig-Maximilians-Universität, Lehrstuhl für Empirische Pädagogik und Pädagogische Psychologie, München.