

Evaluation of teacher education in informatics

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Abstract

MUE (Multimedia supported Evaluation) is a co-operative project in teacher education between the departments of didactics of informatics at the Universities of Dortmund and Paderborn. The aim of MUE is to use multimedia and web-based tools in teacher education to support students of informatics in modelling effective teaching. Students not only learn to integrate multimedia into their classroom teaching processes but also use multimedia as a tool of self-assessment. The paper describes the pedagogical and research concepts of the project. The needs for technical support while integrating classroom experience in courses of teacher education at universities will be discussed and initial practical experiences with this project will be presented.

Keywords

multimedia, teacher education, self-assessment, collaboration, co-operation

Introduction

The teachers' trainer has often recognised various contradictions between the educational aim and the educational practice. The reasons are well known. Universities offer a limited number of exercises in classroom practice. A student teacher takes lessons in both of his subjects on about three occasions maximum (in a group of approximately ten student teachers). This is obviously not enough for an adequate preparation. But the universities are not able to extend these high levels of expensive coaching. Therefore, new ways of teacher education are necessary. Just such a new approach is offered through the multimedia evaluation of teacher education (MUE) project which is supported by the Ministry of Education and Science of North Rhine-Westphalia. The main objective is to stimulate and increase practical skills of teaching informatics in all phases of teacher education. MUE is a co-operative project in teacher education between the

departments of didactics of informatics at the Universities of Dortmund and Paderborn. Videotaped lessons which will be distributed by a video-server and a co-operative platform via internet allow teaching practices of informatics to be developed. As an educational objective of the project student teachers not only learn to integrate multimedia into their classroom teaching processes but also use multimedia as a very convenient tool of self-assessment. The most important conclusions with respect to research are specific strategies of didactics of informatics: analysis and evaluation of social classroom interaction, design and implementation of excellent lessons in informatics, development and evaluation of web-based co-operation scenarios, and the use of multimedia in classroom and at university.

Education in didactics of informatics

Informatics has been a subject of secondary education in Germany since 1972. At present, the educational aims are completely changing from programming of small imperative solutions to modelling, construction and deconstruction of complex and object oriented systems of informatics. But there is a big gap between the didactical needs of subject informatics in schools and the completion of research results in this field. A closed theory for education in didactics of informatics has been missing for a long time. There needs to be an approach to integrate didactical theory and practice. The new contribution of the MUE-project is the connection between curriculum realisation concerning the didactics of informatics and practical classroom experience of teaching informatics. What does application of informatics and multimedia in didactical education mean in the MUE-project? A number of other national and international projects have used videotaped lessons to analyse and to evaluate learning and teaching practices (e.g. Weiss [1]) but only one has been undertaken in the subject of informatics (Magenheim [2]). Two cameras are

normally used to offer different views of the learning and teaching process. In informatics an important part of the activities of learners and teacher are difficult to observe because they are hidden behind the interaction with the hard- and software. Therefore, observational methods should be improved in order to analyse these activities. This could be gained by linking multiple types of information: the digitised videos of the lesson, the teacher students' concepts of the lesson, the digital learning materials with the students' results which are stored in the computer after the lesson, and the results of evaluative discussions between students and trainees. Finally these materials will be stored in a database as a multimedia evaluation document which can be accessed via web-based software with groupware functionality. MUE uses the theoretical basis of constructivism for a student-centred approach to adopt self-assessment and reflective discussions about the videotaped lessons. Because collaborative study is not yet daily practice in university education and in strong contrast with the traditional studying processes of teacher education, the student teacher needs an introduction to the issues, scenarios and tools. CSCL is a sensitive process which requires complex models in order to provide support via distributed systems which are independent of time and location. As far as this is concerned, ambitious informative educational contents can be included in a handling-oriented manner. So the research was carried out into integration of CSCL in traditional group work at university. In this case trainees interact with groups of colleagues, build learning communities and develop skills through group interaction. Learning about personal abilities of teaching is connected with developing aims for personal training. The student teachers make high demands on themselves. International experience in the field of collaborative training (e.g. Chiappini, Chiocciariello, Gibelli [3]) proves the necessity for new social structures in all phases of teacher education. The German institutions of teacher education (universities and pre-service seminars) are organised hierarchically and trainees strongly depend on the experts teaching them. This model is dominated by the experience of professors and teacher trainers to reproduce the traditional state of the art in the next generation. The MUE-project establishes an alternative environment in order to enable the development of new concepts in the field of didactics of informatics. Knowledge in this scenario is generated by the workgroup itself. A more equal exchange of ideas between student

teachers, university staff and pre-service teachers provides an opportunity to develop totally new approaches and to connect these with existing results through collaborative discussions and evaluation. Didactics of informatics is exceptionally well suited to this type of teaching model because a solid base of fundamental knowledge has to be connected with and applied to a number of unsolved problems and research questions.

Research methods and instruments

The main subjects of empirical classroom research could be the teacher (teaching process) or the students (learning process). Learning and teaching processes are linked together very closely and represent different views on the same matter. In seminars, where students want to learn about methods of teaching informatics and get their first experiences in classroom work, it is more profitable to focus on the teaching perspective. To obtain more empirically-founded information about teaching informatics it will be useful to examine the classroom interaction between pupils and teacher and between the pupils themselves. Further objects of empirical analysis of classroom practice could also be teaching styles, organisation of classroom work by the teacher, course materials, writings on the blackboard, curriculum concepts of the lessons, source code and documentation of the software developed by the pupils, keystroke recording of human computer interaction situations in the classroom, results of running tests of the pupil designed software, media support and the technical equipment in the classroom, pupil records in their exercise books, opinions of teacher and students about informatics and objectives, the content and the practice of the lessons attended, and so on. Empirical data can be collected by using qualitative or quantitative empirical research strategies and instruments like interviews, observing and videotaping lessons, assessment of course materials or group discussions about observed teaching practice. Based on theories of constructivism, MUE wants to facilitate the development of the critical evaluation of learning and teaching processes by letting the students analyse their behaviour in the classroom by themselves. To foster this concept, course materials, the plan and the reality of their classroom work, the videos and the assessment of the attending students and tutors will be discussed in the teaching-course at university. They will also be qualified in using multimedia and producing web-based multimedia course-materials with authoring

tools. Therefore, for example, they have to learn how to digitise videos and how to insert them into their multimedia documents. Last but not least, they have to consider the effective integration of interactive hypermedia in informatics lessons and to think about the new role of teachers in computer supported collaborative learning environments. So, after having discussed their lessons with teacher trainers and fellow students at the university seminar of didactics of informatics, teacher students have to create their multimedia assessment documents. The tools used for creating these documents should make the following functionality available to the students: video processing, management of video annotation and web-documents, management of web-based collaboration and content distribution. Video processing software is necessary to cut those video sequences which will be processed in the web documents of the lessons. A video server provides the client software with a video stream. Embedded time stamps enable a time-driven selection of the sequences needed for documentation purposes. Windows with small pictures of the starting frame of the videos, sorted chronologically, support the time-oriented selection of video sequences, according to the course of the lessons. Teachers' and students' views of the videotaped classroom scenarios are always shown simultaneously. The processing screen with a tool for selection of the best audio channel is used (teacher's or student's camera, radio microphone). We are still facing problems with the synchronisation of these different media streams. Included also is a service to delete those video-sequences automatically from the server which are no longer needed for evaluation purposes. The students' ability in the MUE-project to access content on demand even from their living rooms and, at any time, expands didactical education in informatics from a primarily synchronous and 'live' activity to a more flexible self-determined asynchronous event. Furthermore these co-operative platforms and the data could be used by university staff for advanced empirical research in didactics of informatics.

First results

The first results of the evaluation of group discussions and questionnaires answered by the participating teacher students confirm our hypothesis that the concepts of MUE may enhance their self-reflection skills regarding classroom work and their didactical competence. Teacher students expressed the opinion that it has been very useful to

video-tape and discuss their learning and teaching strategies during the seminar at university. They also reported to have learned a lot about methodology and didactical concepts of informatics in a seminar, where they planned their lessons together with their fellow students supported by university staff. The students also criticised the need to minimise the time between videotaping classroom action and discussing the recordings in the seminar. On the one hand they were able to communicate with the developers and to contribute to the design of the user interfaces and the functionality of the software, but on the other hand, they had to cope with the difficulties involved in working with beta versions, which do not always perform perfectly. Students also disapproved of the increased amount of time necessary to meet the various demands of the project. As a result of this it could be argued that the contingent of didactical seminars in teacher education at universities should be increased while the students' other burdens should be reduced. In the beginning, the MUE-project was focused on videotaped lessons of student teachers with strong restrictions. The videos were only used for self-assessment and reflection in one small group. It was recognised that teacher education needs an unlimited database designed to transfer knowledge from one generation to the next. And in didactics of informatics there is a high demand on further education of teachers without university studies in informatics which want to develop new educational aims in information modelling. Therefore, a second branch of MUE started in January 2000 with the recording of best practice examples of pre-service teacher trainer for informatics. This multimedia collection of teaching concepts, video sequences, digital learning material and working results of students is a very efficient support of traditional lectures at university. New models for the teaching of informatics, e.g. updating content and teaching methods can be discussed and demonstrated together. The abstract principles were transmitted descriptively. The student teachers got more differentiated knowledge about teaching and learning processes in informatics. Advanced learning scenarios about informatics contained typical phases: motivation, objective orientation, planning and recording of the activities, allocation of roles, information acquisition, selection of tools, setting up solution hypotheses, recommendation of working strategies, documenting agreements, designing the solution, securing, presentation and evaluation of the results, reflection on the learning

process. Simpler exercises for access to information, the structuring of information, relating to information security which enables a transfer from the computer supported group work are prior to these complex learning scenarios. The MUE-project enables the documentation of the present role of informatics teachers and their professional development. An important issue is to support the change of educational practice through best practice examples. The MUE-team at the Universities of Dortmund and Paderborn carries out research into didactics of informatics. Basic concepts of informatics and their implementation in informatics education were developed. Tele-cooperation as an object and means of development for informatics education was deliberately structured in the project (Schubert [4]). The theoretical concepts will be empirically examined in discussions with school head teachers and teachers, in terms of performance tests, by interviewing students and the video recording of lessons. The areas are linked through the methodology and the tools of research. The observed contradictions between issues and results in educational praxis motivate a new strategy for the application of didactics of informatics. Therefore, recommendations and materials have to be designed and to be proven. The MUE-project supports a new kind of relationship between research, training and educational innovation. At first, the future curriculum of informatics education has to be defined and a desired learning process has to be described. Thus, a number of hypotheses needs an empirical evaluation in the context of the research. The courses can be videotaped at different periods to analyse case studies. A focus for analysis could be the structure of the lessons, the way of solving problems and the students' skills of thinking. The research group has to decide which parameter of the concept has to be changed in the next step to improve the solution. Over a longer period, each step of evaluation can be manifested in a multimedia database. The possibility of storing and retrieval of large quantities of empirical data has a long tradition in didactics. What is new, is the access to multimedia data as well as how to use them to analyse and compare complex learning scenarios.

Conclusions and further work

Initial empirical results based on narrative interviews and group discussions with participating teacher students are encouraging. It seems that the main objective of the project has been achieved, i.e.

to foster self-reflection of future teachers concerning their informatics class-room work and to improve educational practice with a special emphasis on the optimisation of teaching in informatics at school. Also the transfer of know-how concerning methods and content in informatics between the participating institutions will be improved. This will be achieved by an exchange of best practice examples of classroom work in informatics and evaluation documents accessible via a multimedia database and a collaborative platform. Besides these main objectives of the MUE project another important issue has become obvious: teachers and students participating in the project need practical training in the field of multimedia production. The project defines its main objectives for further work within these areas. Evaluation of classroom practice and production of multimedia documents will continue in order to enlarge the basis of empirical data and provide the basis for a didactical theory of informatics. The co-operation between the university partners and the pre-service teacher education institutions will be reinforced. This could be a first step towards the implementation of a strategy to support educators involved in teacher education in informatics in institutions outside the university.

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