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The role of German teachers and researchers in the process of designing and implementing a web-based learning environment

Abstract

Integrating ICT in German classroom practice is difficult for many reasons. A key element plays the teacher. The enacting of curriculum innovations often fails because teachers never have direct contact with the design process. This paper reports a case study with four teachers that are part of the design and implementation process of a web-based learning environment. They work together with science educators following the participatory design approach. Another theoretical foundation is the worldview theory that considers different viewpoints from researchers and teachers as equal even if they are not empirical based but intuitive. First findings show that some viewpoints of teachers and researchers are obstacles to overcome at the beginning of the project. Making the viewpoints explicit seems promising for a fruitful co-operation.

Aims

The level of information technology equipment in education has continually increased within the last years. Computers and the World Wide Web are now available in nearly all German school. Meta-analytic results corroborate the assumption that computer-assisted instruction will lead to equally high and sometimes higher academic achievement than conventional instruction. However, according to PISA only 31 percent of German students, compared to 56 percent in all investigated OECD countries, report on regular exercises with computers (Senkbeil & Wittwer, 2007). A key element of bringing more good ICT practice into classroom is the teacher (Urhahne, Schanze, Bell, Mansfield, & Holmes, in press). He or she decides whether multimedia tools are integrated into lessons (Dexter, Anderson, & Becker, 1999). There are a number of reasons, why teachers decide against computer-based instruction that can be temporal (e.g. preparation time, getting familiar with the soft- or hardware, coordinating rooms, administrators and/or technology), spatial (e.g. having permanent or flexible access to the rooms needed or having enough rooms in school), technical (e.g. having enough and the right hard- and software, having the know-how to handle the technique), or personnel (e.g. not enough administrative capacities, no administrative rights to prepare the lab-session). Many German teachers do not regard multimedia instruction as effective (European Commission, 2006). In addition, not enough research exists about how teachers ought to act during computer-supported instruction when they are not in

the traditional role of teaching in front of the class (van Joolingen, de Jong, & Dimitrakopoulout, 2007). Therefore, special attention must be paid to ways of supporting teachers in performing technology-enhanced instructional tasks (Barton, 2005). Ertmer (1999) differentiates between first- and second-order barriers for why teachers oppose the integration of technology into their curriculum. First-order barriers are extrinsic causes like lack of access to computers or software, not enough time to plan instruction, and insufficient technical and administrative support. These barriers often can be overcome by providing additional resources and training. Second-order barriers encompass intrinsic causes like teachers' beliefs about teaching and computers, established instructional practices and unwillingness to change. These causes cannot easily be modified by focussing on technology and teacher training. The co-operation between researchers and teachers while developing computer supported learning environments according to the participatory design approach (Reiser et al., 2000) seems to be promising. Participatory design recognizes teachers as key players in developing and implementing new curricula into classroom practice with a more equal and responsible role (Carroll, Chin, Rosson, & Neale, 2000). Being involved in the design process of computer-based learning environment does regard teachers' experiences and gives a chance to combine new approaches with established methods of good practice. Nevertheless, experiences with researcher-teacher co-operation report tensions between the two groups that can be related to different viewpoints of teaching and learning. According to the worldview theory (Coburn, 1991) a plurality of viewpoints should be expected. Taking into account that teachers intuitive theories of good practice are based on teaching (and also learning) experience, they could be regarded as "worldviews", strong enough to be resistant to empirical results or well accepted theories, mediated by researchers. So comprehension (of study results or theories) does not determine apprehension (of the necessity to change own behaviour). This paper describes an approach following the participatory design, where German researchers and teachers develop and implement web-based learning materials.

Methodology

In the context of the project CoReflect the German Local Working Group (LWG), consisting of three science educators from the Leibniz Universität Hannover and five teachers living in or near Hannover, is responsible for creating a web-based learning environment on the topic quality of water. The goal of the learning environment is to engage students in inquiry learning practice especially in evidence-based reasoning. Three teachers have long standing teaching experiences whereas the other two have just started their career. One of the experienced teachers has already retired and joined the team in the tenth meeting. One other experienced teacher left the group in the seventh meeting because of private reasons. In addition another experienced teacher joined the group in the tenth meeting. The meetings were co-ordinated by two researchers, one Post-Doc who is experienced in co-ordinating workshops with teachers and one PhD-Student. Because of job reasons the Post-Doc left the LWG after the seventeenth meeting. The LWG has regular meetings every five or six weeks, starting in May 2008 with a summer-break of 8 weeks in-between. Between two meetings the group members work on tasks that were arranged in the foregoing meeting. In March and April 2009 the group met 8 times in total because of finishing the pilot for first enactments. In total the group met 24 times. The meetings last for two hours (about 120 minutes) except three of them that were scheduled in school holidays and last for about four hours. All meetings took place at the Leibniz Universität Hannover. With respect to possible different viewpoints, the researchers encourage the teachers to

take on responsibility for the design of the content. All meetings are documented in written form by the PhD-student of the LWG who was present at all of the meetings except of one. The notes are structured in the following sections: meeting date, participants of the meeting, topics, results, open tasks/issues, personal impressions. Whereas the first three topics are static, the other topics provide information to the process of the meeting. The group members are also asked to document their work between the meetings. Additionally the two teachers who were enacting the pilot in their classes (one experienced teacher and the teacher on probation) were interviewed using a semi-structured interview developed by Constantinou. Data will be analyzed qualitatively following the case study research method (Yin, 2003). The focus of the case study will be on the development of the teachers' viewpoint of their role in the design process and of teaching in a web based learning environment. As we have teachers with different experiences in the group we expect different roles in the LWG. We also expect different viewpoints of the teachers and researchers, some fruitful for the whole designing and implementation process. In this presentation we will present findings based on the notes taken by the researcher in each lesson and the results of the interviews.

Findings

As the project is currently running, the process of data generation is not finished yet. But first findings of an analysis of the data collected thus far give a good insight into the local working group processes. They will be reported under two aspects: 1. Defining one's own role and taking responsibility, 2. View about computer-supported inquiry learning in classroom practice.

1. Defining one's own role in the LWG and taking responsibility

As mentioned above the researchers introduced the LWG with the participatory design philosophy that teachers and researchers have equal roles. Both perspectives should be taken into account when making decisions on the design and the content of the learning environment. That includes also the responsibility for every step in the developing and testing process. The researchers expected that the teachers would take the lead in deciding on content and learning goals, based on their classroom experience.

- The process of role definition took long, what was not helpful for the design process. The teachers were very hesitant in making decisions in any case. The first meetings general topics were discussed, like school the learning environment focus on chemistry or biology?, what will be the learning goals? etc. were discussed extensive without really coming to conclusions. Even the teachers had different views about the role of the experiment or about the balance between domain knowledge and process-oriented competencies. The group started the process of finding the driving question by sharing information and sources they already used about the topic. These materials had a great diversity. This is not at all a problem. But it seems that this was impeditive for the group. It took a few meetings to decide on the content and other components of the learning environment like experiments or graphs. After the seventh meeting the researchers decided to give more advise (pre-structuring the material and setting more specific goals for the meeting). The ninth meeting was reported as constructive with success on deciding for the content and structuring it. But still on the tenth meeting the teachers do not take the lead on deciding for the next steps do. Finally the two mentioned

changes in the group composition seemed to have a main impact on the group dynamics. At first, the tenth meeting, when two new teachers joined the group. The younger teacher immediately took an active part. He volunteered to report on students' reasoning and evaluating competencies and on teaching the concept of sustainability. This influenced the group in paying more attention to connections between the contents. The other change in the group was after the seventeenth meeting when one researcher left the team and only one researcher was co-ordinating the meetings. The following meetings were more structured with concrete tasks for the teachers. The researcher did this on purpose, on the one hand because he has the impression that the teachers will accept this gladly, on the other hand because of little remaining time. He knew that this would not be supportive for the general goal to give more responsibility to the teachers. When one of the interviewed teachers was asked to reflect on his impressions about the group dynamics he confirmed the impression that the teachers were waiting for the researchers decisions. He also confirmed a better group dynamic at the time the one researcher left the group because now the teachers got more clear advise. We regard this as evidence for the difficulty to establish responsibility to the whole group of its own volition.

- In the first meetings the teachers do also not work serious on tasks between the meetings. After an introduction of the learning environment STOCHASMOS in the second meeting they got accounts to use the demonstrator "Detective Story". The researchers asked them to let us know in case they have difficulties with the environment. At the seventh meeting the group talked about special features of the learning environment and the researchers realised that all of the teachers did not really know how to learn with the platform. One mistake might have been to start with an emphasis on developing the inquiry environment that was regarded as a structured collection of sources like a textbook: one of the teachers planned to work only with the inquiry environment and to give instructions in a whole class arrangement and with additional working sheets. Most of the teachers felt a need for restructuring the inquiry environment the time they discussed the structure of the workspace. At this moment some of them still did not understand the role of the templates in the workspace (see also 2.). We regard this as evidence that still in this design based research approach it is difficult to overcome second order barriers according to Ertmer (1999)

2. View about computer-supported inquiry learning in classroom practice

The process of developing the learning environment confirms the assumption that the teachers have different views about inquiry learning in classroom practice compared to the researchers.

- In some meetings it was difficult to decide on content or the structure of the learning environments because the teachers often reflect the possible decisions on their regular classroom practice: Does the learning environment allow to evaluate the individual achievements? Can I justify so much time working on only a few learning goals? What will be the domain knowledge mediated by the learning environment? Does it cover the curriculum? - For

some teachers domain knowledge is seen as most important. It is not necessary to always have a consistent connection between the domain knowledge and the context. This could be part of the teacher e.g. to make this connection in whole class discussions.

These positions were not supportive for the design process of the learning environment. The teachers gave lot of input about what could also be part of the learning environment without really reflecting whether it is feasible or conducive to the driving question. The reason why they did not feel uncomfortable with the indefinite status of the learning environment was that they know about their alternative to left STOCHASMOS and guide the classroom sessions.

- The teachers fear to have open-ended problems and let the students learn an indefinite time without guidance. They prefer to ensure that the students reach the learning goals rather than having a debate that might end in a controversy. They accept a focus on socio-scientific issues but sometimes there is a fear that the researchers have very ambitious but not realistic learning goals. The first meetings the group had several discussions about the main goals of the learning environment. In case the focus should be on socio-scientific issues, the teachers will prefer an “one-solution” design. It took some discussion in the very first meetings to make the project goals clear to the teachers. The report from the new teacher about experiences, sustainability and the role of procedural competencies was very supporting for this process. He often shares the same view with the researchers and took more and more responsibility for the socio-scientific part in the design process of the learning environment. The novice teacher expressed in her interview that this input was very helpful. She would prefer more experts to be invited and contribute to or consult the project.
- Difficulties were also identified in how to use ICT in classroom practice. The teachers fear that the computer may be misunderstood as a substitute to regular classroom practice and not as an additional method. At the beginning they did not support the workspace idea and its scaffolding features. Some of the teachers preferred to have more control by giving instructions and having classroom discussions.
- The group also has discussions concerning the use of real experiments vs. computer-based materials like simulations. The researchers regard simulations as a supplement, when real experiments are not possible. The teachers argue that most of their colleagues will make use of the simulations even though they are able to perform real experiments. For the teachers experiments are essential in the learning environment. The group decision was to have both, working sheets for the real experiments and videos that show the experiments, implemented in STOCHASMOS. A group of teachers supported by the technical assistant from the IDN spent several sessions to test the experiments and record the videos with very good results. Because of the server performance and the time needed for viewing them, they changed to pictures with explaining texts. Similar to the domain knowledge it was more important to have the experiments for supporting the basic concepts than connecting them to the context of the learning environment. (By the way:

The first enactments were very surprising to the LWG. The students could decide between doing the real experiments in the lab or getting the information via STOCHASMOS. No student decided to go into the lab.)

Conclusion

The first data analysis shows the potential but also difficulties of the participatory design. Different worldviews can be identified between researchers and teachers. There are also difficulties in placing responsibility for design decisions on the teachers. The researchers started with only monitoring the design process. But they recognized that the teachers did not identify with this role. The researchers began to revert to an old role (pre-structured meetings and more guidance) and the teachers felt more comfortable with the situation. The researchers still believe that it is possible and essential to give the teachers the more active part in the meetings. A meeting with the whole CoReflect project group in summer 2009, when all LWGs were reporting about their first experiences, was motivating for the teachers and could have been helpful for identifying with the project tasks. This is a necessary pre-condition for accepting responsibility. The teachers also got an insight on the role of different STOCHASMOS tools with very illustrative examples from the other LWGs. This might modify the teachers' beliefs about the technology in classroom practice and hence help to overcome second order barriers. For answering this hypothesis further data will be gathered and analysed in the next period.

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