The „handlungsorientiert" Notebook-Seminar

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Abstract - The Notebook-Seminar is a project-based learning scenario. An extensive project task has to be solved by a maximum of 20 students at the Institute of Communications Engineering (University Hannover) over a period of one semester. During this period, the students learn selected topics about communication technology (for example Bluetooth); thereby they acquire on one hand technical knowledge and on the other hand important methodological knowledge and soft-skills. These are for example how to work in teams, how to organize the work, or how to use the new media technologies for the engineering work. To develop these skills the "notebook-seminar" is organized with fixed learning tasks (information, planning, decision, carry out, control and assessment), specific learning tasks (e.g. producing a project plan), and learning support facilities (e.g. notebook).

Index Terms – handlungsorientiert, Notebook-Seminar, project-based learning, project task, soft-skills

GENERAL

The "Notebook-Seminar" is a learning scenario which should improve the actual engineering education while integrating the use of notebooks. It's one of four different learning scenarios that are developed at the University of Hannover. Several institutes are participating in the project "UbiCampus" (www.ubicampus.uni-hannover.de). This project is funded by the BMBF (German Federal Ministry of Education and Research; www.bmbf.de). The goal of the BMBF program "Notebook University" is to promote, develop, test, and implement the use of notebooks in advanced learning concepts in academic education.

The first notebook-seminar was practised from October 2002 until February 2003, actually (1.3.03) improvements and preparations for the next upcoming notebook-seminar are on-going. The second notebook-seminar will be held from April 2003 until July 2003.

In this paper we begin by outlining the starting point of the development of the "notebook-seminar". Then, we describe the practical and also an exhaustive evaluation of the results are discussed.

CONCEPTION OF THE NOTEBOOK-SEMINAR

Consideration of the contemporary history

The development of the Notebook-Seminar has started with a consideration of the contemporary history for adapting the Seminar to the vocational requirements. The purposel is to prepare students for their engineer occupation optimally.

We consider the change from the industry to the knowledge-society as the most important alteration in the contemporary history. This stands "for the shift of material to informed social and intellectual resources as basis for economy and society" [1], which evokes also lasting changes in the working world. Particularly the reducing of half-life in knowledge [2], the discontinuation of routine jobs [3] caused by the automation, and the establishment of the information-technologies [4] results in changed requirements to the engineers. A good education should get the bearings by these requirements, therefore it was examined which kinds of skills are demanded. The results [5] which are based on a literature research are presenting a multitude of skills to promote. The most mentioned are:

- competence of learning methods
- competences of team work and communication
- competence of media
- competence of management and project management
- competence of business
- competence of legal
- competence of intercultural

Vocational Decision-Making and Responsibility

By examining the curricula of the engineering education conspicuously it is evident that the support of these competences especially takes place conditionally. Our aim for the Notebook-Seminar concept is to meet this deficit by using a learning method, which makes it possible to impart the additional skills in a technical-oriented education. We needed to find suitable methods in the German pedagogical system, which pursues this aim with the "handlungsorientiert" teaching concept. Opposite to the usual technical terminology of the education objectives, (i.e. Ohm's law then bleeder), the "handlungsorientierte" teaching

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concept formulates the achievement of the vocational decision–making and responsibility to act as a comprehensive education objective. In this context somebody is called "capable of acting", if he has the competence and abilities of the occupation. Furthermore he should be able to solve work item flexible, as well as capable and ready to participate dispositive in his field of work and his company [6]. The vocational areas of competence are apportioned in categories. The most frequently used sort is the division in professional competence, methodical competence and social competence [7]:

a) "Professional competence": A person possesses professional competence if he has responsible and expert over tasks and contents of his working area, as well as he has specialised knowledge.

b) "Methodical competence": A person possesses methodical competence if he reacts appropriately to workitems, finds independently ways for solution just as transfers experiences clever on other work items.

c) "Social competence": A person possesses social competence if he is able to work with his colleagues cooperatively and communicatively. If he possesses group oriented behaviour and shows interpersonal understanding " [8].

The demarcation of the competences is not clear. An example for the overlap is the media competence. It contains as well technical, (i.e. knowledge over the service of a computer), methodical, (i.e. introducing in a new software), as also social aspects (i.e. in which situation I write a mail and when a telephone call is more important). This differentiation allows the determing of the learning content, which are necessary to learn the successful vocational action. The systematic contempltion of the learning contents concerning the specialised knowledge is expanded by issues needed for a successful vocational action.

Methodology

Methodical postulate of the "handlungsorientiert" learning is to structure the learning process based on the complete vocational action. This includes those actions which are necessary to finish a vocational task. It contains working on vocational tasks [9] and receives the character of project-oriented learning [10]. Thus "handlungsorientiert" learning is actively discovering, organized, and a cooperative learning [11], which moves the learner into the center of the educational efforts. The positive effects of this method results in a better transfer and keeping information in the mind [12].

In order to structure the action, the training aims are to be embedded into complete action phases. From an originally three-phase model (planning, executing and controlling) a six-phase model was developed. This contains [13] inform, plan, decisions, implementing, controlling, and evaluating [14].

Based on these action phases we structured the Notebook Seminar and teach the students to work on complex tasks consciously and systematically. Moreover, the following characteristics were formulated as guiding priciples of "handlungsorientiert" learning: goal-oriented, subject oriented, prosess and product oriented, systemically [15]. The planning of an appropriate learning arrangement should consider these characteristics.

Planning of "handlungsorientiert" Learning

When planning an "handlungsorientiert" learning it is to be particularly made certain that the arrangement is developed in an action systematic manner, not in a specialized systematic.

This is an important aspect which is often ignored in realization. Often specialized systematic exert influence on planning. However setting of tasks in „handlungsorientiert" learning is to be placed in such a way that "the associated problem is to be solved only by the independent development of the appropriate theoretical occupational knowledge" [16]. It follows a tightrope walk between the systematics.

In practice a pragmatic instruction becomes generally accepted [17] if it contains certain aspects of planning. Beside the "action-systematic" arrangement specified already and the six action phases, defining of the education objectives is indispensable. These are to be assigned appropriate learning actions in order to know the necessary abilities. A learning action can for example provide a project plan. By working on this task the students learn the systematics leading to complex tasks of project.

The integration of the Notebook

The integration of the Notebook withhin the above-mentioned learning methodology should not be used for an over-directed control of learning processes. But it can be used as "Information and tool offer for self arranged learning processes" [18], where the purpose of the training can be determined as media competence. Because of the main learning target is to impart a vocational decision–making and responsibility during the learning process, the Notebook is used as a typical engineers tool.

These media competences are improved by the use of the Notebooks, which are important for the everyday professional life of an engineer. In the following section some typical engineer actions are enumerated:

- documenting (e.g. text processing)
- calculating (e.g. cost calculation)
- administration (e.g. spare parts depot)
- presentation (e.g. research results)
- planning (e.g. project planning)
- configuring (e.g. installation, error analysis devices and plants)
- communicating (e.g. email)
- informing (e.g. WWW, News Groups)

- simulating (e.g. electrical circuits)
- archiving (e.g. connection diagrams, layout plans)

Regarding these many functions, the Notebook becomes the engineer's all -round-tool. FIGURE 1 figures out this.

FIGURE 1
THE NOTEBOOK AS AENGINEER'S ALL-ROUND-TOOL

The use of the Notebook at the university should have continuity in real working life. Practice shows that the Notebook in the engineering profession is established firmly. For the purpose of "handlungsorientiert" learning, a typical engineer's action can be integrated in the learning process. Examples are the presentation of project results by means of appropriate software, the simulation of circuits, or the organization of the group work over online calendars.

The mobile surplus of the Notebook

An elementary question for the project "Notebook University" is the mobile surplus compared to a stationary computer.

By integrating the Notebook into the "handlungsorientiert" learning process, a typical engineering work methods and talents are particularly acquired. A practice-oriented task, which composes a pedagogical surplus, prepares the students authentically for the vocational requirements.

In the learning process the advantage of a stationary computer is in the spatial independent availability of the Notebook. The students can access appropriate applications at any time, e.g. project planning during a seminar date, presentations or procure information. The constant availability might obtain a substantially more intensive use than with stationary computers. By this intensive employment of notebooks, the desired learning targets will be much better reached. A further advantage of spatial independence is that the university need not provide expensive computer pools. The seminar can take place in each area suitable for training meetings. This is an important aspect regarding the broad introduction of such a seminar in the university. The discussion of the evaluation at the end of this paper will outline and show if the partial expectations formulated here are coming up.

REALIZATION OF THE NOTEBOOK-SEMINAR

In order not to let the realization of the Notebook-Seminar vanish in the pedagogic sense, following the conception, we represent the realization based on practical examples. Since the Notebook-Seminar was accomplished in the study of the communications networks, the examples are aligned accordingly.

Determining of learning ojectives and learning tasks

First, the preparation which has to be performed in the determination of the learning targets: these depend on the study plan. Beyond that the interdisciplinary competences was brought in by us (see section "Consideration of the contemporary history"). It was shown that in our study plan the fixed time frame of 4 semester periods per week can contain only a fraction of the the interdisciplinary competences. Therefore we had to be limited to the most important competences.

According to the determined learning targets, we defined the actions which have to proceed during the learning process. They have to be integrated in the project task.

In the following they are represented by professional competenc, methodical competenc, social competenc, and media competenc. The differentiated representation of the media competenc was chosen because the Notebook is a special part in the framework of this research project.

Professional competence
The impart of the professional competences lies in the topic "Bluetooth technology". To provide this project task, the "Bluetooth technology" was brought up for discussion. Learning targets are the technological structures and functions. Beyond this, an exemplary work on this technology should be done to strengthen the learned contents of the basic lectures about the communications networks.
Also, at the beginning of the seminar the students get selected materials about Bluetooth. This is to facilitate the independent entrance for them in the topic and the execution of the work on the project.

Methodological competence
The proposed methods are oriented towards the vocational field of engineering. The learning objectives with the learning tasks turn out as follows:
- **Methods of the communications networks:** The task of the project is arranged in such a way that methodical proceeding in the form of subtasks implies. Furthermore, the tutor of a group has to advise these in methodical questions of communications networks and mirror his own experiences.
- **Competences of project management:** Here the students must provide a project plan. The work procedures are to be outlined and seized into a time

frame. The project plan has to be discussed with the Tutor and to be checked if it adheres to the deadlines. The students have to document and discuss the deviations.

- **Competence of learning methods:** The competence of self learning is supported by working independently as much as possible on the project task. The tutor advices with it´s experienced.

Social competence

The learning objectives with the learning tasks turn out as follows:

- **Team capability:** The team capability is stimulated by working on groups of 4 to 6 participants. Team rules are suggested to the groups, according to which the students should interact in the groups. Furhermore, the group can define additional rules. Also each group chooses its own group name. The Tutor of a group observes the cooperation and interferes in case of problems (e.g. if a participant separates from the group work)**.**
- **Competence of presentation:** The students must conduct a presentation in the process of the seminar several times in front of the group, thus developing a systematic ability for presentations. The following seminar phases are intended for this:
  - During the prelude meeting the students must introduce themselves personally.
  - In the progress report each group member must represent the current state and she/he is proceeding with the project.
  - For the conclusion of the term each group member must present his work and results. This should cover if possible a time framework of 20 minutes. Afterwards she/he has about 5 minutes to answer questions posed to his workout.

Media competence

The media competence is to be obtained though the Notebook. The learning objectives with the learning tasks turn out as follows:

- **Competence of technology:** The students get the Microsoft Office package (documentation, presentation) as default to work. Beyond that an introductive information are placed ready for project work only on a learning platform. It concerns predominantly relevant web pages which make information and forums available to the Bluetooth technology (e.g. www.palowireless.com).
- **New forms of medial working:** Merging the Notebooks into the operational readiness level phases is to support appropriate action defaults. So the students must present their project results e.g. with a presentation software. They also have the possibility to exchange their project results over a learning platform, document archives and their own panel.

Production of the project task

Providing a project task requires a precise preparation. It is the key to a successful Notebook-Seminar and within the project the central reference point for studying. Following the characteristics mentioned as guidance concepts (see methodology) a good project task is characterized as follows:

- It must show a clear aim of the project for the students. This applies both to the total tasks and to the subtasks.
- The subtasks must be good prepared (i.e. the demarcation to the other subtasks must be precise).
- It should represent an interesting topic for studying, thereby increasing the motivation clearly (e.g. Bluetooth, a very new and by itself, a far spreading terminal technology).
- It must show a clear part in the general field of study (e.g. Bluetooth is a technology in the communications networks field).
- It must contain precise procedural instructions, so that the students know exactly what to do (e.g. developing and implementing it a ad-hoc-location based services for the Bluetooth technology).
- It must designate the basic conditions for the execution of the project (e.g. document your project results). On the one hand these are derived from the learning goals, on the other hand from the organizational framework of the Notebook-Seminar (e.g. running time of the term).

All-in-all it should cover a maximum of two pages of the overall project (general and specific representation of the total task; boundary conditions) and a maximum of one page for each subtask.

Organization

For a good cooperation of all involved ones the organization of the Notebook-Seminar is very important. A seminar-plan gives solid time-deadlines, which serves as a milestone for the project-work to be completed. This should depend on the 6 complete action phases (informing, planning, decisions, execute, controlling, and evaluate). The following example clarifies this:

a) Inform (1.-2. week): Training for the Bluetooth technology
b) Planning (3. week): Provide a project plan
c) Decisions (date X): Delivery of the project plan
d) Execute (4. - 10. week): Accomplish the project
e) Control (date Y): Delivery of the project documentation and correction by the tutor.
f) Evaluate (12. week): Final evaluation of the project results. Here a written and verbal evaluation is the center of attention, in order to give to the studying a feedback.

A precisely defined schedule for the students gives them the advantage to finish their project at the fixed date. This is

important for the study plan. Furthermore postponing the tasks of the project will not embarrass them, and also stop them from aborting their work. Our experiences have shown that the students require an intensive support. This is not due to the fact that they have to act in an unknown learning scenario and acquire for themselves many things. An example is the providing of the project plans or the organization of the project work in the group. In order to offer an optimal support, the students have to appear once in a week to meet their tutor in the university. Often a meeting only takes a quarter of an hour but helps the students during the accomplishment of the project work. Normally after the meeting the groups continue working together on their project. Thereby they almost use exclusively their Notebooks.

EXPERIENCES, RESULTS & SUMMARY

The execution of the Notebook-Seminar was finished by an evaluation. The evaluation is based on the documentation of the events by the tutors, and a questionnaire which enquire the students about their feelings and experiences. Mostly the collected empirical data corresponded to the subjective impressions of the tutors. In the following selected results of both evaluation parts are continuous represented?

Have the students used their Notebooks?

This question can be clearly indicated by yes. 8 of 14 students declare that they have used their Notebook "always in the Notebook-Seminar". The remaining 6 used their notebook „often". The integration of the Notebooks into the designed learning scenario has to be rated as a success. Figure 2 shows a typical meeting of the students with their tutor by using the notebooks.

FIGURE 2
STUDENTS WITH THEIR TUTOR

Concerning the question whether the students used their Notebooks also in other lectures (1 student use it always, 3 student use theirs often, 2 students sometimes, 5 students rarely, 3 students never use their notebook). The

answers differ highly. Particularly the indication of the "5 rarely" is suggesting that the students have tried to use the notebook in the lectures, but they could not recognize a considerable surplus.

This is corresponding with the experiences of other projects (e.g. University of Bremen). It shows that the establishment of the Notebooks only takes place in the university teachings if it is possible to integrate the notebooks reasonable into the learning process.

The results concerning the question, "what the notebooks were used for", also represented a positive outcome. For these actions: documention, presentation and investigation, indications are that, the students range from "often" to "always" in performing those actions. This result is not amazing, since the actions were explicitly demanded in the project work, however, during the project work it turned out that the students also used their Notebooks to simulate appropriate sections of their tasks. In line with this, 3 students always, 3 students often, 4 students sometimes, 2 students rarely and 2 students never used their notebooks to simulate part of their work. Surely a broadly strewn result, but remarkably, the task of project did not make any defaults relevant. While students do not like simulating in laboratories and exercises, they preferred this form to analyze their results in the project work voluntarily. This raises the question whether laboratory work can be converted into an appropriate project work.

Another further investigation was, where the students preferred to use their Notebook. They indicate that they worked 43% of time in the university and 54% at home. The remaining 3% belongs to other places e.g. on the way or on the work. Thus the mobile surplus of a notebook is used in comparison to a stationary PC with a portion of 46%.

The mobility of the notebooks makes an intensive utilization of the new media possible. Trough this, media competence is promoted explicitly by the reference of the typical work methods of engineers.

Summary

The experiences of the students in the Notebook-Seminar were a welcomed alternation and they proceeded their project tasks with a high commitment. Their time spent corresponded to the credited semester periods per week. The technical and the multidisciplinary results were very satisfactorily. But a clear deficit occurred in the specified learning goal "competence of project management". It failed the coordination of the single results in view of the complete project task. This deficit should be removed by a corresponding qualification of the tutors. In addition, in regular intends the groups will be asked to coordinate the results of their projects.

The positive feedback from all persons involved in the Notebook-Seminar, students, professors and tutors, encourages us to continue with the Notebook-Seminar. Next work includes how to possibly integrate further, „handlungsorientiert" learning or participatory learning in

the engineering education. A problem is, that the Notebook-Seminar seems to push the boundary of the existing curricula. In the second project support phase we hope to be able to solve this question.

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