

# Improving learning progress with learning technologies in postgraduate professional education with extreme heterogeneous participants

**Abstract** Today learning is rather a life-long process than a one-time task. In this regard media and PC competence is a key qualification. Keeping that in mind this project is about relating prerequisites of learners to their learning behaviour in distance learning postgraduate professional education. We centre our main focus on what effects media/PC competences and fulfilled / unfulfilled expectations of the participants have on their learning result in a virtual learning environment with extremely heterogeneous participants. Future work will deal with setting up a virtual learning environment with specific functions. A didactical, pedagogical and social concept will be made to support learners in a cooperative learning process. Main goal of this project is to observe the influence of deficits in handling new media / computers and arisen expectations on learning progress and to map out a strategy to countervail this behaviour.

## Introduction

The culture of learning has changed a lot in recent years: Instead of learning once and doing this job for the rest of your life everybody is responsible to refresh and upgrade his knowledge. This leads to the three "I": Life-long learning. Observations show that in many fields the life cycle of knowledge is getting shorter and shorter, especially in computer science and information technology.

New Media and learning technologies can support learners to organise their learning activities. They can get together in virtual learning environments, specially if they take part in a distance learning program. But to coordinate and make use of all available functions of these technologies the learners and teachers must dispose of appropriate media/PC competence.

Traditionally, access to knowledge was linearly teacher-centred. New learning technologies enable non-linear and learner-centred access to knowledge. So the instructivist approach is more and more substituted by an constructivist one. But how does this change of learning culture influence the access to knowledge, specially in postgraduate professional education using new learning technologies?

The distance learning SIGNAL-project<sup>1</sup> trains teachers for the subject computer science. We evaluate our experiences during the SIGNAL-project, combine these results with results from other projects and draft improvements regarding learning behaviour and use of technical functions for the SIGNAL- and similar projects.

Hence we apply research results from the area of new learning technologies and virtual learning groups to postgraduate professional education to support the learning process. After that we analyse the usage of learning technologies regarding self-organising learning processes if the target group of learners is extremely heterogeneous in many fields. Last of all, we want to relate the media/PC competence, motivation, use of learning technologies and chosen learning path of the different learner groups to their learning success and adjust our didactical, pedagogical and social concept<sup>2</sup>.

## SIGNAL-Project

The SIGNAL-Project is preparing teachers of all disciplines to additionally teach computer science at secondary schools. This subject will start in 2004 in entire Bavaria at all secondary schools. The curriculum of this course of studies contains the following fields of computer science: Databases, Modelling, Object-oriented Modelling and Programming (OOM/OOP), Computer Architecture and Operating Systems, Computer Networks, Algorithms and Data Structures and Theoretical Computer Science.

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<sup>1</sup> Sofortprogramm Informatik am Gymnasium - Nachqualifikation von Lehrkräften: Action Program Computer Science for Secondary Schools - Postgraduate Professional Education for Teachers

<sup>2</sup> Cf. [4] (extended German report in progress)

### We do have . . .

Our target group of learners consist of adults who are already employed teachers. They all volunteer for this extra occupational, postgraduate professional education course on computer science. They are geographical unequally distributed and somewhat isolated from each other. The course takes two years and is composed of distance learning units and face to face classroom teachings<sup>3</sup>. The classroom teachings are held monthly in the first and weekly in the second year.

The learning material was created specifically for this course of studies. Shared CBT, online material and lecture script is used during the first year. This material was developed at university of Passau and TU Munich for the use at all universities. During the second year special lectures are held at each university.

We direct our main attention to the heterogeneity of the participants in many fields: They have varying knowledge about computer science (theoretical and practical), different motivations to take part in this postgraduate professional education, expectations on the distance learning course and social conditions e. g. family status, with or without children, city or. country environment, sex etc. All these factors we subsume to the term prerequisites. The major difference seems to be whether or not they have the qualification to teach math (Fakultas Mathematik). We will refer to this as subject mathematics.

### We do not have . . .

Five Bavarian universities (Erlangen-Nuremberg, Passau, Würzburg, Technical University and Ludwig-Maximilians-University Munich) cooperate in this project. However there is no integrative learning infrastructure.

There are several separated BSCW server in use and one Lotus Notes Quickplace server. Overall, there is neither didactical, pedagogical nor social concept regarding the use of these learning technologies. Between the students of the different universities there is no cooperative learning environment planned.

To support the learners with their different knowledges and various backgrounds in this distance learning project, it is advised to provide a learning environment connecting learners both in their courses and especially over the five universities. The didactical, pedagogical and social concept must be customised to the needs of the learners and we have to assure that the media/PC competence is sufficient to access and work with the learning materials.

It seems as an essential question to us how learners without subject mathematics can take advantage of the better ones with subject mathematics!

## Initial observations

During the preceding academic year we have evaluated every module of the course. We observed a significant different behaviour between learners with or without subject mathematics (as one of the main prerequisites):

- We look at the motivation to work on their weekly exercises. Table 1 shows how often the exercises were done by learners with or without subject mathematics during the first three module:

Module	Learners		Ø
	with subject mathematics	without	
Databases	96	90	95
Modelling	81	58	76
OOM/OOP	68	47	64

**Table 1: Done their weekly exercises (in percent)**

- We will catch a glimpse of the ending tests of each module:

Test of module	Learners		not passed	
	with subject mathematics	without	with	without
Databases	17	6	0	2
Modelling and OOM/OOP	15	4	1	2

**Table 2: Test results**

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<sup>3</sup> In combination with used CBT- and online-material we refer to blended learning approach according to [8, page 4 f.]

- And we will look for those learners who terminated the course prematurely:

	Learners			terminated prematurely	
	Sum	with	without	with	without
		subject mathematics			
Erlangen-Nuremberg	25	18	7	0	2
Munich (LMU)	25	17	8	1	4
Munich (TU)	28	21	7	0	2
Passau	21	15	6	0	1
Wuerzburg	25	15	10	2	2
Total	124	86	38	3	11

**Table 3: Overview about prematurely termination**

This altogether shows that learners without subject mathematics have more problems to reach a similar completion as learners with subject mathematics. And they are more susceptible to abnormal termination. These results seems obvious but we want to design a questionnaire to identify other prerequisites like sex, interests, living and social environment, expectations on a virtual learning environment, media/PC competence etc. which may have an effect on the individual learning process. We want to include special aspects of extra occupational adult education.

Regarding the use of technical infrastructure we observed that after occurrence of technical problems the infrastructure was partially avoided. Some participants were not able to use main functions because of incompatibility between server software and browser after a server update. The willingness to try again later on was low. These participants switched to traditional communication (email, phone). Only a minority tried again and succeed<sup>4</sup>. An important question for the SIGNAL- and related projects is how do these factors influence the motivation, choice of learning path and materials, using functionality within the learning technology, doing their exercises etc., in all the whole learning progress. We shall address some of these in the following sections.

## Main Goal

We plan to develop a didactical, pedagogical and social framework incorporating constructivist aspects<sup>5</sup> for postgraduate professional education to support the learning progress. We pay attention to an extremely heterogeneous field of participants, the use of learning technologies regarding different prerequisites in many ways, problems which arise from private or professional pressure, social an professional environment, leisure activities, personal motivation, previous knowledge, ability to deal with problems etc. The aspects with the strongest impacts are to be identified first. On our way we have to deal with the following:

### Learning Community

Because of the distribution of the learners over entire Bavaria and monthly resp. weekly meetings there is the need to bring them together virtually [7, page 196 ff.]. It's most common to set up a technical infrastructure (learning technology) with specific functions: The learners can access any kind of documents, communicate with each other, take part in discussions and perhaps collaborate. But to bring such a learning environment to life, a critical mass of learners and activities is necessary according to [6, page 17].

<sup>4</sup> Quotations from participants emails: "Quickplace ist eine Katastrophe - Lediglich eine weiße Browseroberfläche und ein schwarzweißes Anmeldefenster, welches einen nicht mehr weiterläßt, [...] [Netscape / Opera / K-Meleon]. Anbei [per Mail] die gelösten Übungsaufgabe zum Übungsblatt 2" "Sieht ganz so aus, als ob ich meine Blätter jetzt wenigstens mit Netscape 4.8 wieder einreichen kann! (Mozilla habe ich noch nicht getestet.)"

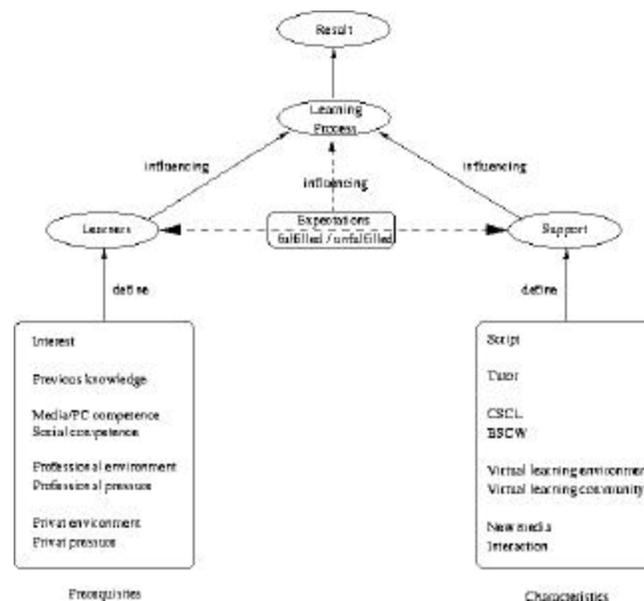
<sup>5</sup> [2, page 1]: "In the field of instructional design there has been, during the last decade, a shift from 'instructivistic' approaches towards 'constructivist' approaches. Instructivistic theories assume that formal concepts and systems can be transmitted to students by giving them formal descriptions in combination with the presentation of examples. Constructivistic approaches emphasise the idea of an active, experiencing student in a situation where knowledge is not transmitted to the student, but constructed through activity or social interaction."

## Heterogeneity and Prevailing Conditions

The goal is to reach a constant and effective learning progress for every learner despite different prerequisites of the learners regarding knowledge, social environment, motivation, interest and especially subject mathematics. Therefore we choose a virtual learning community including a constructivist approach. Communication between learners with different levels have lasting positive effects on motivation, learning progress and knowledge.

## Didactical, pedagogical and social concept

Learner-centred education is more suitable for learning technology-supported distance learning than teacher-centred education. The teacher becomes a coach to guide the learners through the content and assist them to select the appropriate path and material. But using learning technologies does not necessarily imply a didactical and pedagogical concept. Learning in such an infrastructure demands special cognitive skills from the learners. This corresponds with the requirements of life-long learning with new media according to [1, page 1].



**Figure 1: Are there any correlations between prerequisites of the learners on the one hand and the characteristics of the support on the other hand which have strong effects on the learning process?**

The results of correlation between prerequisites and learning culture (including the chosen learning path, communication techniques, self-organisation) of the participants will be consolidated in a model. It should be universally valid within similar learning environments. This model will be included in the next term of the course and is portable to similar projects.

## Approach

We will assess the media/PC competence of the learners and set up a learning technology with specific functions. Specific functions are functions to cope with a specific task. According to the result we will train the media/PC competence of the learners to enable them to use their individual abilities purposefully in conformity with the learning technology offered.

To reach a critical mass of learners we will connect the learners of all courses across all five universities. We will direct our attention to any correlation among different prerequisites and competences of the learners, use of specific functions of the learning technology and resulting progress and success of learning.

Later on we will try to exploit the results to adjust our present system and draw up a new didactical, pedagogical and social concept under constructivist aspects regarding the specific needs of learners with different prerequisites including the subject mathematics, living and social environment etc.

## **Media/PC Competence**

At first we will draft a questionnaire for all participants to evaluate their media/PC competence<sup>6</sup> and other background information: This contains the classification in different competences<sup>7</sup>. An evaluation between self-classification of the competence and personal conditions especially subject mathematics will be made. Immediately after that, a training or upgrade of the media/PC competence must follow. One of the questions investigates their capability to self-organise their own learning path in a blended learning environment.

## **Learning Environment**

In parallel, we will decide on an adequate learning technology to meet the claims of learners and teachers<sup>8</sup>. Because of the use of BSCW server in other universities a preliminary decision was made for this course. But we will evaluate several other techniques against BSCW and will be able to make use of this evaluation later on in the project.

Complex and wasteful software must be avoided. The advantage and profit must be clear to the user.

Otherwise the technology will be disregarded. Another result is that the learning technology must be used unforcedly and permanently by all groups: Teacher, tutor and learners according to [6, page 17 f.].

## **Didactical, pedagogical and social concept**

Provisionally we will adopt the didactical concept of the preceding academic year. But soon after the analysis of the learners' competences we will design a didactical, pedagogical and social concept that respects the learners' needs tending to their competences and subjects in consideration of a constructivist approach.

We plan to follow the ideas of [1, page 5 f.]: A moderate constructivist approach to learning is an (inter)active, self-driven and constructive process. The process of interaction embraces perception, interpretation and action. Learning as a process of construction is more precisely an act of interrelation between construction, de-construction and reconstruction. Although learning is an individual process its success depends more than ever on interactions with other learners.

## **Evaluation and Adjusting**

In the next term this concept will be evaluated regarding the usage of learning technologies by particular groups of learners with respect to the self-classification of their media/PC competence and other prerequisites.

Overall, the tutors must guide the learners regarding both their media/PC competence and knowledge especially about mathematics and their other prerequisites<sup>9</sup>. According to their tight schedule of the course besides their job, social environment, other professional training and leisure activity etc. there is no time to waste so the learners are dependent on learning path suggestions and selection of learning material. We will consider this and how the learner deal with this pressure during evaluation and establishment of the learning technology.

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<sup>6</sup> [6, page 4] states, it is very important that both teacher and learners have appropriate media/PC competence. Lectures should be accompanied by media-didactical offers: "Über die genannten didaktischen Ansätze hinaus ist es für derartige computerunterstützte Lehrveranstaltungen zentral, dass Lehrende wie Lernende über die notwendige Medienkompetenz verfügen. In der Regel sollten medienintegrierte Lehr-/Lernveranstaltungen daher auch durch mediendidaktische Angebote begleitet werden."

<sup>7</sup> According to [5, page 5]: Basic competence covers use of email, word processing software, the Internet and computers (including skills to (un)install software, update the operating system, file management). Special competence includes additionally knowledge in spreadsheet, multimedia and graphic software. Universal competence means furthermore statistical software, web authoring and at least one programming language.

<sup>8</sup> [3] states: "However, what also became evident was that merely providing a specific functionality, e.g. the option of rearranging documents within work areas or creating new links/gates between work areas, does not necessarily mean this functionality will be widely used by the students - this would appear to require a culture of open cooperative work. And such a culture can only be created by long-term practice." And the authors conclude: "Viewed pragmatically, open-sTeam thus exceeds the expectations and needs of some users."

<sup>9</sup> According to [1, page 1]: For a didactical and pedagogical concept in a virtual learning environment it is not so important to prepare the information best for knowledge transfer, but to support learners in their autonomous learning process.

## Conclusion

In this article we presented the SIGNAL-project dealing with distance learning postgraduate professional education. We reported initial observations regarding learning progress and behaviour between groups of varying prerequisites and social environments. We drafted a proposal to ascertain the main prerequisites and the arising difficulties in the special field of extra occupational adult education and to compensate the differences in an extremely heterogeneous field of participants by using new learning technologies and a virtual learning community. At first we will assess the media/PC competence and other prerequisites of the learners. Then we will set up an adequate virtual learning environment to connect tutors and learners from all universities. After that we want to analyse the correlation between prerequisites and learning progress and propose a didactical pedagogical and social concept for the SIGNAL- and related projects.

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