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Motivational Aspects in Technology-Enhanced Courses

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Abstract: This paper presents a quantitative study on students' motivation in technology-enhanced courses. Four technology-enhanced courses with differing course designs were investigated concerning their impacts on student's motivation. Results show that, although the designs vary only in some didactical elements, the course designs differ significantly concerning students' motivation and the motives that drive commitment and performance. The paper discusses several motivational, didactical elements and further results regarding their implications for course designs.

Introduction

Motivation in and for learning is a widely researched topic as it is an important quality that affects performance and success. Studies have illustrated that motivational issues are fundamental factors that drive a student's performance (e.g., (Ames, 1992; Durik & Harackiewicz, 2002; Van der Merwe, 2007)). When motivated to learn, people tend to engage in activities they believe that will help them learn. Especially in the early days of (pure) e-learning, people mistrusted that students could be properly motivated without the physical presence of a teacher or fellow students. With the emergence of new technological facilities for online learning and the increasing experience with such learning environments, the skepticism tailed off and people came up with creative experiments. Finally, with the turn towards technology-enhanced learning environments that mix presence phases with online elements, concepts and models were formulated.
The ARCS model (Keller, 1987) was the first motivation model, which provided instructional designers a systematic process of incorporating motivation into the instructional design process. It captivates due to its proven validity and reliability (e.g., (Astleitner, 2000; Vafa, 1999; Visser, Plomp, & Kuiper, 1999)). Additionally, the non-prescriptive approach of this model has been experiences as practical and widely applicable in technology-enhanced as well as in traditional learning setting (Visser et al., 1999). These considerations, finally, lead to the decision to adopt the ARCS model in our course design and basement for analysis.
The paper is organized as follows: The next section is dedicated to motivation models in technology-enhanced learning settings. Besides the presentation of the ARCS model, the theoretical part of this paper will briefly describe the time continuum model model by (Wlodkowski, 1993) and the supermotivation model by (Spitzer, 1996) since both complement and illustrate the chosen approach. Section 3 gives a detailed description of the courses under investigation emphasizing the respective course designs and didactical elements. It further presents the research questions and methods used for approaching these questions, concluding with a description of the sample. Section 4 discusses our study's findings. The final Section concludes the paper and points to issues for further research.

Motivation in Technology-Enhanced Learning Environments

The ARCS Model of Motivational Design

John Keller synthesized existing research on psychological motivation and created the ARCS model (Keller, 1987), which was validated in several studies in many contexts, like in classroom-based instruction, distance learning (Visser et al., 1999), web-based learning (Vafa, 1999), multimedia learning (Astleitner, 2000), and computer-aided

instruction (Song & Keller, 2001). Keller identified four main categories for motivating instruction to help educators with initiating and sustaining learners' motivation. The acronym ARCS stands for Attention, Relevance, Confidence, and Satisfaction. According to the ARCS model, these four categories represent the necessary conditions for fully motivating a person. This approach pays special attention to the application in e-learning environments and provides recommendations. In the following, each category is briefly summarized:

- ***[A]ttention:*** Gaining and maintaining the learner's attention and interest is crucial for motivation. Often it is easy to gain attention in the beginning of a course or lesson. Sustaining attention, though, is a challenge. Creating curiosity and stimulus are, thus, key components. Keller (1987) identified following three subcomponents: perceptual arousal (through new, unexpected and controversial events), inquiry arousal (confronting learners with questions and problems, which have to be solved), and variability (deployment of different methods and media).
- ***[R]elevance:*** It is crucial that learners perceive the content to have a value for them. Each blended learning course should clearly state its benefits. Relevance can be promoted through familiarity, goal orientation, and motive matching. The more familiar something is, the more relevant the learner perceives it to be. Metaphors, vivid examples, and images can be used to describe abstract and non-familiar terms and concepts in order to make a connection to something familiar. Educational objectives should be presented, the importance and usefulness of the subjects highlighted, and the instructions explained. In order to fit students' different learning targets, the course design should and provide students the opportunity to determine goals by themselves. Several learning strategies, which suit the learners' motivation profiles, should be offered. In a blended learning environment, it is good to have a range of tasks – such as group work, self-study projects, and friendly competitions. So students can better match their motives or values when choosing relevant tasks themselves.
- ***[C]onfidence:*** Confidence and positive success expectation are the third condition, which must be fulfilled for motivating learners. The risk to fail should be minimized as students will put effort into a course only if they think they are able to achieve the objectives with reasonable effort and time. In the beginning of a course, objectives, required skills and knowledge should be clearly outlined and examples of acceptable achievements provided. Additionally, students will gain confidence in their own abilities when they experience success at challenging tasks. The learners should clearly know that their success is based upon their efforts and abilities, which can be supported by adequate feedback.
- ***[S]atisfaction:*** Learners should obtain satisfaction and reward from the learning experience. A good way to achieve satisfaction and intrinsic reward is to see new skills as being immediately useful. Learners should have meaningful opportunities to apply new skills or knowledge in real or simulated situations. Positive feedback and reward can also reinforce the learner's motivation and effort (e.g., in self-assessment tests). Furthermore, it is important that students experience fairness, for instance, by making evaluation criteria transparent.

The Time Continuum Model of Motivation

The time continuum model by (Wlodkowski, 1993) has certain similarities with the ARCS model by (Keller, 1987) but differs in that the time continuum model is a prescriptive solution while the ARCS model has a strategy selection from a set of categories based on a synthesis of concepts in human motivation (Visser et al., 1999).
According to (Wlodkowski, 1993), there are six factors that influence learner motivation: attitude, need, stimulation, affect, competence, and reinforcement. In the Time Continuum Model of Motivation, the learning sequence gets divided according to a time continuum. Three critical periods in the learning process have been identified where motivation is most important:

- ***Phase 1 – Attitudes and Needs:*** In the beginning of the learning process, the learners' needs have to be identified and the designer should consider how the instruction would best meet the learner's needs. A needs assessment can be done before developing instruction. The instruction should allow for choice and self-direction in assignments. Furthermore, positive learner attitudes for this learning sequence and the content have to be facilitated. The awareness of the material's importance should be enhanced.
- ***Phase 2 – Stimulation and Affect:*** During the learning process, learners are motivated by the stimulation provided by the new learning material and the effects of their experience with it. Wlodkowski (1993) suggests several ways to provide stimulation to learners. The use of different modes of instruction – from lecture to group work to discussion – is recommended and the presentation style should vary. The work with the material should be helpful, interesting, and satisfying. Furthermore, the learning experience should be personalized and relevant for the learner. At last, a positive affective experience and emotional climate for learners in the online as well as in face-to-face learning sequences should be facilitated.

- ***Phase 3 – Competence and Reinforcement:*** The final phase is an opportunity to increase or affirm the learner's feeling of competence and to provide reinforcement at the conclusion of this learning sequence. For the feeling of competence, frequent feedback and the communication of the learner progress makes sense. Online sharing of papers, reports, and project works with fellow students can also provide students with a feeling of accomplishment. Reward should be given in any form that seems suitable. Additionally, students should be made aware of how the new knowledge enables them to do what they could not do before. For tasks and assignments, it is always good to use realistic contexts or cases studies, so that students see the relevance of the content to daily life and feel accomplishment.

Supermotivation Model

The Supermotivation model was developed by (Spitzer, 1996). The core assumption is that any activity can be made highly motivating if a motivating context is added to the basic task. The concept puts emphasis on the activity rather than on the individual. Spitzer describes his motivation model with one vivid example in the context of sports: many activities like for example golf can be rather boring by itself, golf is repetitive and not very exiting without the context of the game. According to (Spitzer, 1996), games are motivating because they include action, fun, variety, choice, social interaction, error tolerance, measurement, feedback, challenge, and recognition. Those ten factors can also be applied to learning situations in technology-enhanced learning communities for motivating students.

Investigated Courses

All courses under investigation were conducted at the University of Vienna, Faculty of Computer Science, as part of the Curriculum on Computer Science and Business Informatics. The only course that was compulsory and part of the Bachelor studies was Web Engineering. All other courses were part of the Master's curriculum and could be chosen from the pool of elective course combinations ("core subject combination"). Thereby the courses on Soft Skills and Organizational Development belonged to the same specialization field. Some students, thus, participated in these courses in subsequent terms.

Description of Courses

Subsequent paragraphs briefly describe the investigated courses. In general, each course has about 20 participants and for each course the workload is about 5 credits point according to ECTS (European Credit Transfer System). They are conducted in the form of blended learning courses, thus, including both presence phases and online elements. Except for Web Engineering, the courses include self-evaluation and peer evaluation of students' projects, and employ online reaction sheets after each presence phase.

- ***Web Engineering (WE):*** In the course Web Engineering, students learn about methods and processes to plan, model and develop web information systems. In the beginning of the term, students build teams of three or four. During the term these teams have to develop a small web application with XML web services. The specific topic can be chosen according to personal interest. Various analysis and design techniques like UML, XML, PHP or Java have to be chosen according to their suitability to support the development process of the particular application. As students work in teams, cooperative learning is experienced. The module Web Engineering follows a blended learning design mixing presence and online activities. Students are assigned to create documents or model program parts of their web project. For each phase, students have to provide these documents on the e-learning platform. They present milestone results in the laboratory course units (presence phase). For quality assurance of the student team's projects, partner team evaluation is deployed.
- ***Soft Skills (SS):*** This course primarily aims at improving students' competencies in project work situations, in particular team communication, ad hoc presentations, and moderation techniques. The course is based on active, experiential learning (person-centered learning) and accompanied by an e-learning platform for knowledge intensive inputs and materials. The facilitator moderates the initial three workshops; in the units thereafter, students take over. More precisely, based on their interests, student teams (about 3-4 persons each) are free to choose a particular soft skills topic, which they prepare and thereupon they moderate their own workshop. Feedback is given during the workshops as well as in online reaction sheets (Motschnig-Pitrik, 2006a).

- ***Person-Centered Communication (PCC):*** The core goal of the course on Person Centered Communication is to allow students to experience a person-centered atmosphere based on constructive openness, acceptance and empathic understanding and to provide space for unfolding and experiencing their (inter)personal capacities and communication styles in a non-directive, unstructured setting. While the major part of the course takes the form of unstructured encounter groups (Rogers, 1970), three initial workshops are dedicated to sensitize students to issues of active listening (Gordon, 1974), the person-centered approach (Rogers, 1983), sharing of ideas in small teams, and the idea of encounter groups (Motschnig-Pitrik, 2006b). Additionally, students had to prepare a seminar paper in teams of three to four persons. For these papers, students could freely choose any topic related to person-centered communication. All student papers are peer evaluated and, finally, every individual evaluates his or her contribution to the course.
- ***Organizational Development and Business Processes (OD):*** This course aims at allowing students to experience selected, authentic issues of organizational development and to model business processes on the basis of distinctly expressed strategic goals. The course involves group decision-making procedures, team exercises, and small-scaled team projects around topics that students select from their perceived need of areas amenable to organizational development. The topics and projects are introduced in three workshops; their presentations, detailed discussion and process reflection take place in four consecutive days co-facilitated by the instructor and an international facilitator (Motschnig-Pitrik & Santos, 2006).

Overview of Didactical Elements

The courses under investigation pursue different approaches concerning didactical elements, which are assumed to have a particular impact on motives and motivation. For the purpose of clarity we grouped these elements by following topics: basic elements, teamwork, and feedback and evaluation elements. Table 1 provides an overview of the didactical elements:

Basic Elements:

- ***Self-initiative rewarded:*** Self-initiated learning processes are promotive and allow students to bear responsibility (Bauer, Derntl, Motschnig-Pitrik, & Tausch, 2006; Rogers, 1983). If the facilitator correspondingly rewards such self-initiatives, students will be ambitious and motivated.
- ***Practice orientation:*** We believe that practice-oriented courses immanently emphasize the relevance factor. Furthermore, in contrast to dry theoretical units and courses, practical exercises and stressing the links to professional live will spice up the course and, thus, be motivational.
- ***Person-centered course style:*** Our approach to technology-enhanced learning, i.e. combined presence phases and online learning, builds upon humanistic educational principles as realized in the Person-Centered Approach (PCA) by Carl R. Rogers, (Rogers, 1961, 1983). PCA derives from psychotherapy and is based on the three dispositions congruence, acceptance, and empathy. This non-directive style furthers a significant kind of learning that integrates new elements, knowledge, or insights to the current repertoire of a learner's own resources (Barrett-Lennard, 1998). Altogether, this approach is expected to improve motivation, as already could be shown in a scale of studies (e.g., (Aspy, 1972; Cornelius-White, 2007; Motschnig-Pitrik, 2006b)). The way in which these core conditions can be expressed in technology-enhanced learning situations is discussed in more detail in (Motschnig-Pitrik & Mallich, 2004).

Teamwork: Work in small teams is a proven method for furthering self-directed learning and is, thus, an effective, promotive activity in learning environments. Students tend to learn more contentedly through social interaction and seem to be less strained but rather motivated (Bauer et al., 2006; Tausch & Tausch, 1963/1998).

- ***Free choice of topic:*** When students may choose a topic they like, motivation is assumed to rise, since a self-chosen topic is one that a student is interested in. Moreover, such a topic will be one that a student currently concerns and for which he or she perceives its relevance (Bauer et al., 2006).
- ***Team seminar papers***: Team based learning stimulates 'interactive' motivation, such that team members promote each other to reach a higher level. Furthermore, (Tausch & Tausch, 1963/1998) observe supportive behavior within teams, which provides students with a sound basis of knowledge. When having reached such a solid foundation, students are more likely to be motivated for further learning than when they lack in the necessary basics.
- ***Moderation of course units***: When student teams are given the opportunity to design and moderate course units on their own, they leave the course with the feeling of cooperatively having accomplished something that they

feel is important for their future jobs (Motschnig-Pitrik, 2006a). Not merely the relevance but also the responsibility for a course unit paired with the space for being creative will drive a student's motivation.

- ***IT Project work:*** Project work combines several motivational aspects. First, projects are highly practice and goal oriented. Furthermore, it includes teamwork and requires commitment.

Feedback and Evaluation Elements:

- ***Team peer review:*** Particularly in computer science courses, team reviews are gaining importance as didactic techniques. Through reviewing their peers' work, students develop awareness of their own work's quality (Figl, Bauer, Mangler, & Motschnig-Pitrik, 2006), which we assume to have a positive impact on motivation.
- ***Self-evaluation:*** Introducing self-evaluation to a course assures students that their contributions are fairly assessed and are not merely dependent on a facilitator's impression. According to (Keller, 1987), we expect this transparent and fair evaluation scheme to have a positive impact on motivation.
- ***Feedback:*** Constant feedback from the facilitator throughout a course provides students with an indication about the current states of their performances (Keller, 1987; Tausch & Tausch, 1963/1998). We assume that feedback gives students the feeling that their contributions are taken seriously, which, in turn, has a positive impact on motivation. Consequently, we expect course designs with regular feedback scoring higher in motivation than courses without.
- ***Reaction sheets:*** A powerful online element is the provision of transparent reaction sheets, which students can use to express their likes, dislikes, observations, learnings, suggestions, etc. Including reaction sheets in the course design allows students to express their thoughts and feelings. The initial minutes of the following presence unit are then devoted to discussing student's reactions and deriving potential consequences on subsequent units. Based on this feedback, educators may adopt the design as required by the needs in a particular course (Figl et al., 2006). This tailoring is expected to increase motivation since students have the possibility to express themselves and perceive the feeling of being taken seriously. And, finally, the course is designed to meet their particular needs.

Didactical Elements	Person-Centered Communication	Organizational Development	Soft Skills	Web Engineering
Basic elements				
• **Self-initiative rewarded**	x	x	x	
• **Practice orientation**	x	x	x	x
• **Person-centered course style**	x	x	x	
Teamwork				
• **Free choice of topic**	x	x	x	x
• **Team seminar papers**	x	x		
• **Moderation of course units**			x	
• **IT project work**				x
Feedback and evaluation elements				
• **Team peer review**				x
• **Self evaluation**	x	x	x	
• **Feedback**	x	x	x	
• **Reaction sheets**	x	x	x	

Table 1: Didactic elements potentially influencing motivational aspects

Research Questions

This study aims at identifying motivational factors based on a range of courses while highlighting differences of course designs. The four courses under investigation have the same background as regards the university, faculty, field of study, course coordinator, technology-enhancement as didactical means, and partly they even include the same students. These courses, however, differ as regards didactical elements, which will – according to above-described motivation models – differently affect students' motivation. The first research question is thus: ***How do the four courses under investigation differ in motivating students?*** Besides driving students' motivation in varying degrees, the different course designs are expected to spark distinct interests and motives, which leads to the second research question: ***Do these courses differ regarding student's motives for commitment and performance?***

Method

These main research questions are addressed in a scale of the evaluation questionnaires and evaluated in a post-test design. The research of the courses took place from summer term 03 to winter term 06, while each course took one term. In the last week of a course, students of the investigated courses were asked to fill out an online evaluation questionnaire. Data was collected as reference values for the comparison by asking the students to answer the questions also for a typical course in their studies.
For measuring motivational aspects, a self-constructed pool of items was collected. Likert-style rating scales (Likert, 1932) were used since they are highly suitable for measuring attitudes, especially in the context of learning and in the form of online questionnaires (Page-Bucci, 2003). We used verbal labels for the rating scales that were experienced as equidistant in the German language (Rohrmann, 1978). The answering format consisted of five verbal labels: 'strongly disagree', 'somewhat disagree', 'partly / partly', 'somewhat agree', 'strongly agree'.

The Sample

Table 2 illustrates the sample's distribution among courses and the response rates. Altogether students filled out 817 questionnaires, whereas the selected scales per questionnaires differ between courses. The response rate was, thus, 88%. Only 17 out of those students filled out a questionnaire of one and the same course twice in different terms because they failed the course and had to repeat it; this only affects the course Web Engineering.
Most questionnaires derive from the course Web Engineering (529) since it was a compulsory course of the Bachelor studies. The high number of questionnaires for Person Centered Communication (171) is due to the fact that this course took place every term. Soft Skills and Organizational Development have fewer questionnaires since these courses belonged to a specific "core subject combination"; especially Organizational Development took place only twice within the investigated course design.
80% of participants were male, 20% female. These percentages are comparable with the general gender ratio in computer science, the curriculum that 95% of the courses' participants study.

	Course				Overall
	Web Engineering	**Person-Centered Communication**	**Organizational Development**	**Soft Skills**	
Questionnaires	529	171	38	79	817
Response rate	81 %	96 %	83 %	90 %	88 %

Table 2: Sample size and response rate

Results

To find out whether students are motivated by different reasons to take part actively in the investigated courses, a non-parametric procedure Chi-Square Test was calculated for all items. Since the precondition of normality was not met for most items, a variance analysis could not be calculated. This was probably due to the fact that most items were answered in the affirmative, which led to right skewed distributions. Calculating sum scores did not seem appropriate for motivational aspects since the whole set of items was not used in all courses and specific item-related results were of particular interest.
The whole set of items on motivational aspects includes 42 items. Since each of the investigated courses adopts a slightly adapted course design, some items, which are relevant in one course, are irrelevant in another course. Hence, only a subset of items was included in each course's questionnaire. For this study, 22 of 42 items were selected from the whole set of motivational items. Only items, which were included in the questionnaires of at least three courses, were included for this investigation. For 20 out of these 22 items, the Chi-Square Test was significant, which indicates that students assigned different grades of importance to those aspects in the investigated courses. No differences between courses could be found for the two items "I wanted to get a good grade" and "I like to solve real problems". Probably these motivational attitudes of students are independent from the courses they currently attend. Unfortunately, no post-hoc tests seem to be appropriate to test, which courses actually do differ. Hence, the answers' means were used for interpretation, which are illustrated in Figure 1.

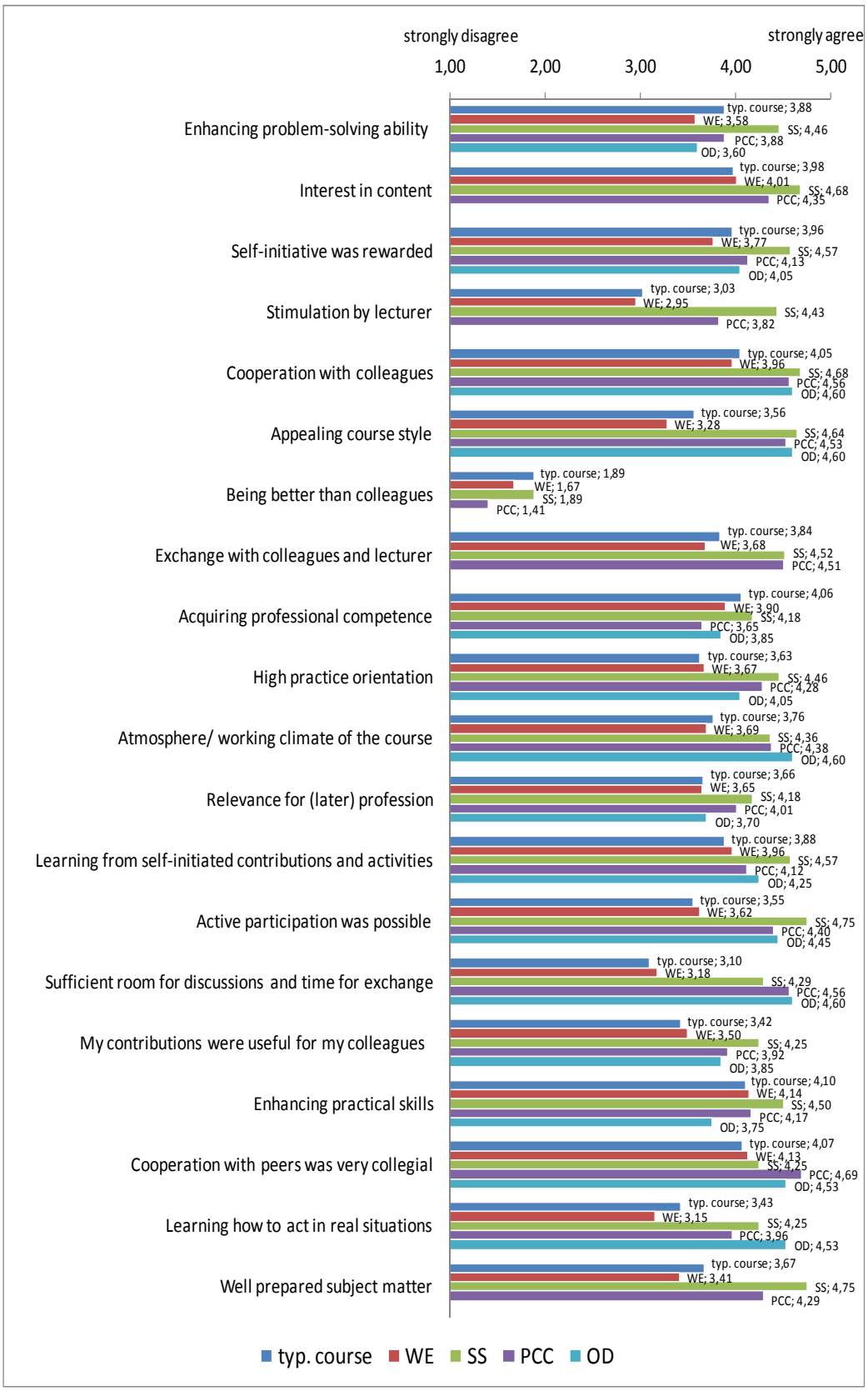

Figure 1: Motivational aspects in several courses

In general, data show in evidence that students judge most aspects to be less motivating in Web Engineering and in a typical course compared to Soft Skills, Person Centered Communication, and Organizational Development. The only two questions against this trend are "Being better than colleagues" and "Acquiring professional competence". Concerning the motive of "Being better than colleagues" the answers were rather similar for these groups of courses. Only Person-Centered Communication shows a slightly weaker agreement concerning the competition aspect. However, this finding is not surprising, since this course strongly integrates the person-centered approach and is built on encounter groups, which both target personality growth rather than competition.
The only question that students agreed to a similar extent for all courses was "Acquiring professional competence". Since no differences could be found, striving for competence may be related to a didactical element, which is inherent in each of the investigated courses, or may have other than didactical reasons. Further investigation is necessary concerning this aspect,
Compared to other courses, Soft Skills scored especially high for "Enhancing problem-solving ability", "Self-initiative was rewarded", "Learning from self-initiated contributions and activities", "My contributions were useful for my colleagues", and "Enhancing practical skills". This is probably due to the fact that student teams prepare and lead workshops in Soft Skills, which affords high self-initiative and is experienced as being more useful to colleagues than contributions in other courses. Although furthering self-initiative is also an imminent part of the course design in Person Centered Communication, in this course the implication of one's contributions and the effects on fellow students are not immediately apparent. As the internalization of the person-centered approach's essence takes time to evolve, students may not be able to realize the true value of what they have learned and the relevance for everyday and professional life at the time when they filled out the questionnaire.
In Soft Skills and Person Centered Communication also the following items were agreed more strongly than in Web Engineering and in a typical course: "Interest in content", "Stimulation by lecturer" and "Well prepared subject matter", suggesting that participating students were deeply interested in the topics of the course.
Furthermore, the results show clearly that students experience the person-centered teaching style of Soft Skills, Person Centered Communication and Organizational Development to be more motivating than the regular style of Web Engineering and a typical course (items "Appealing course style" and "Atmosphere/ working climate of the course"). In these courses, students found the cooperation with colleagues ("Cooperation with colleagues" and "Cooperation with peers was very collegial"), the room for discussions and exchange ("Active participation was possible", "Sufficient room for discussions or time for exchange", "Exchange with colleagues and lecturer") as well as the high practice orientation ("Learning how to act in real situations", "High practice orientation") highly motivating.
The fact that Soft Skills and Person Centered Communication score higher in the item "Enhancing problem solving ability" than Web Engineering and Organizational Development might be due to the courses' contents. New input regarding soft skills and person-centered communication can be immediately put into practice as both topics are not bound to specific situations but are relevant in everyday life. Web Engineering and Organizational Development are designed for solving particular problems in work life. Students with jobs in the field of computer science are more likely to see the practical relevance of these courses than students who have not yet entered work live in the field of computer science and will, moreover, profit immediately from their learnings. The high score in "Interest in content" for Soft Skills and Person Centered Communication strongly supports this interpretation since it seems apparent that students are more interested in topics, which are relevant in their current lives. Furthermore, Soft Skills and Person Centered Communication find more approval in the item "Relevance for (later) professional life" than Web Engineering and Organizational Development. This is a further indication for above argument that students do not perceive the link to their professional lives for topics of Web Engineering and Organizational Development as these subjects might not have such a high relevance in their current lives. Obviously, the practical relevance needs to be better punctuated in these courses and examples revealing the link to current needs have to be given.

Conclusions and Further Work

Despite the limitations of a post-test study, the results demonstrate that the course design has a significant impact on students' motivation and on the motives that drive commitment and performance. The high appreciation of the person-centered approach and its satisfactory impact on motivation confirm the teaching team to pursue with it.
Surprisingly the course Web Engineering, which did not follow the person-centered approach, scored even lower than a typical course in many motivational items. As the design for this course implements some of the motivational, didactical elements that the other courses include as well, further research is necessary in order to investigate whether those elements that are not implemented in Web Engineering are determining. Since Web Engineering is

part of the Bachelor's curriculum while the other courses belong to the Master's curriculum, it has to be considered that students might have different motives at different stages of their academic career. Furthermore, the involvement of facilitators, which were not active in the other courses under investigation, could be a reason for Web Engineering's distinctiveness compared to other courses concerning this aspect. Moreover, the fact that Web Engineering is a compulsory course within the Bachelor's program while the other courses are not has to be considered. Further research, investigating the reasoning for this finding is necessary.
Although motivation theories and models emphasize that relevance can come from the way something is taught and does not necessarily have to come from the content, results show that students see the course's relevance more clearly if also the content is relevant to their current lives and needs.
Further research should lead to more sophisticated and effective applications of motivationally adaptive course design. The results of this study give a good idea of motivational aspects in the investigated courses and emphasize that course design of Web Engineering has to be reconsidered. Particularly in this respect, our research illustrated the limitations of learning design patterns. Design is just one factor, the implementation of the design is at least as important. Furthermore, attention has to be paid to the end users – the learners –, who have specific requirements and desires, which may be distinct in different settings.
Since project work is widely regarded as a promotive didactical element, but this could not have been shown in our study, we consider paying special attention to this aspect, which is established but hardly researched. In pursuing this goal, we will particularly include our course on Project Management in our future research.

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