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Student-Centered Teaching Meets New Media:
Concept and Case Study

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Abstract. There exists empirical evidence proving that students who are given the freedom to explore areas based on their personal interests, and who are accompanied in their learning by a supportive, understanding facilitator, not only achieve superior academic results but also develop socially and grow personally. However, pure Student-Centered Teaching is more demanding in terms of communication, organization, as well as the provision of learning material. Thus, the basic idea underlying our paradigm is to combine Student-Centered Teaching with eLearning in order to exploit the advantages of the two approaches. We refer to this combined style as Student-Centered eLearning (SCeL). Strongly simplified, the computer takes over the task of providing information, while presence phases can be used for giving the content more meaning by means of transparent, open, respectful and empathic interactions within the group. Our case study indicates that Student-Centered eLearning has the potential of reducing the increased demands of Student-Centered Teaching in the long run, while fully retaining all its benefits, such as deeper learning processes, personal growth, social skills, and a higher degree of flexibility. Furthermore, the maturity for life-long learning is cultivated. In this paper we introduce our concept and derive first hypotheses on the conditions under which our paradigm appears most effective. While potential continuations of our studies are manifold, we intend to employ SCeL in the course of the new curriculum of the medical faculty of Graz University where a Virtual Medical Campus (vmc.uni-graz.at) is currently being developed.

Keywords: Student-Centered eLearning (SCeL), Student-Centered Teaching, Carl R. Rogers, Experiential learning, eLearning, Life-long learning, Person-Centered Approach, Humanistic psychology, Medical education.

Introduction

The purpose of this paper is to present and to discuss a humanistic educational paradigm that has its roots in the well-acknowledged and thoroughly researched approach of Rogers's Student-Centered Teaching and supports this paradigm by the use of New Media. The term New Media refers to all media, rather than "new" media because these, take for example the Internet, are not as new as everybody thinks. However, we define *New Media* here as any digital media objects that include interactivity and are digitally distributed (Holzinger, 2002). The basic idea is to use the computer as a versatile, adaptable tool for information transfer, while devoting the 'saved' time to encourage experiential and social learning within the classroom. Further, the paper shares Renate Motschnig's experience in the use of New Media as a tool within the Student-Centered Approach aiming at improving the quality and effectiveness of learning and teaching. With this approach we aim to achieve deeper learning processes that provide more meaning to both learners and staff, by applying fundamental psychological and didactic principles. The approach is targeted at enriching and reorganizing ordinary presence courses for advanced students working in groups of modest size (say up to 25 students per course). Experience in this area is intended to provide a guide for the adaptation of the approach to other kinds of courses including ones with a stronger orientation towards distance learning (Sanderson, 2002).

In the year 2001, a case study involving advanced courses in requirements engineering and web design was performed to assess the relevance of combining Student-Centered Teaching, as developed by the well-known American psychologist Carl Rogers (1902 – 1987), with the use of the Internet. In particular, we wanted to find out, whether a customized version of Student-Centered Teaching would fit into our conventional curriculum at the University of Vienna and the related grading system. The answer to this question is clearly positive, and the experiments provided valuable learning and insight regarding technical, practical, pedagogical as well as attitudinal issues that we wish to share with the readers. We further intend to experiment with students of medicine within the totally new module based curriculum at the medical faculty of Graz University which is supported in parallel by the Virtual Medical Campus Graz (vmc.uni-graz.at) and enables more problem-based learning (PBL) and bed-side teaching. Andreas Holzinger is one of the two main investigators in this project. Some works to date indicate that Student-Centered Teaching can play a significant role in contemporary medical education and related research activities on the key impact of relationships in the learning environment (e.g. (Howe, 2001; Carlile, 1998; Glew, 1994). Rigid educational programs are giving way to more adaptable and flexible ones, in which student feedback and patient participation have increasingly important roles (Jones, 2001).

In brief, the Student-Centered approach is based on the hypothesis that students who are given the freedom to explore areas based on their personal interests, and who are accompanied in their striving for solutions by a supportive, understanding facilitator not only achieve higher academic results but also experience an increase in personal values, such as flexibility, self-confidence and social skills. This approach, also known as experiential learning, requires specific personal attitudes on the side of the instructor who takes over the role of a facilitator.

These attitudes are highly transparent, open communication, positive regard towards students and the seeking for deep understanding (Rogers, 1983; Aspy, 1972).

While the positive effects of the "pure" Student-Centered approach have been proved in a number of case-studies and are well-documented in the literature (Rogers 1983; Baxter, 2001; Chase, 2001; Gamboa, 2001), its combination with the Internet as a resource for acquiring knowledge and as a medium for supporting communication is a novel asset. We refer to this combination as Student-Centered eLearning (SCeL). In our work we argue that, due to the fact that the Internet opens up vast knowledge and communication sources, it largely frees the “instructor” from acting as a pure knowledge transmitter. It thus provides room for personal- and group processes in the presence phases and thereby optimally supports Student-Centered Teaching, being directed towards *learning as a whole person* including intellect as well as feelings, also known as *experiential learning*. SCeL is particularly well suited to support, small teams of students who cooperate on a project each by contributing his/her special knowledge and skills (Ryback, 1998). These groups and their members can follow their individual work styles, stay in their preferred locations and work environments and nevertheless share documents freely on the web such as to stay up to date in their cooperative work. In fact, all course participants unanimously appreciated the convenient access to their shared documents, allowing them to coordinate their cooperative project work between the presence phases and use the latter for discussion, presentation, feedback, etc.

From the instructor's (also the authors’) point of view it became apparent that SCeL requires communicative and social skills that are very different from the qualifications needed for conducting conventional courses. Generally speaking, the case study led to the hypothesis that the Student-Centered Approach grows in effectiveness with respect to deepening learning- and teaching processes, in the case that:

- Sufficient amounts of material are electronically available (eContent). More precisely, the material could as well be otherwise easily available, such as in the form of books and journals, although, in our experience, availability in electronic form proved most versatile and time effective.
- Instructors, preferably facilitators hold the personal attitudes necessary for providing a constructive learning climate, can communicate these attitudes (Rogers, 1961) and have advanced social- and communicative skills.
- All participants succeed in employing the computer as a resource for significant parts of knowledge transfer as well as for some aspects of communication and organization.

The paper describes the general method and compares it with other didactic styles in order to discuss the relationships, commonalities and differences. We then discuss our specific adaptation of SCeL to conventional curricula, and describe a particular setting for the method's application in advanced courses in requirements engineering and web-design. We further discuss the results from the students' and instructor's point of view. Finally we draw some general conclusions and derive hypotheses regarding time-effectiveness, quality and amount of eContent, the instructor's social skills, and the transition process.

Student-Centered eLearning: Method and categorization

Student-Centered Teaching

In arguing on a learning style that has significance for the individual, Carl Rogers describes *whole-person learning*, being the goal of Student-Centered Teaching, as follows: "Significant learning combines the logical and the intuitive, the intellect and the feelings, the concept and the experience, the idea and the meaning. When we learn in that way, we are whole, utilizing all our masculine and feminine capacities." (Rogers 1983, p.20). In this spirit, Student-Centered Teaching can be characterized by the following goals. It aims toward:

- a climate of trust in which curiosity and the natural desire to learn can be nourished and enhanced;
- a participatory mode of decision-making in all aspects of learning in which students, teachers, and administrators have their part;
- helping students to achieve results they appreciate and consider worthwhile, to build their self-esteem and confidence;
- uncovering the excitement in intellectual and emotional discovery, which leads students to become life-long learners;
- developing in teachers the attitudes that research has shown to be most effective in facilitating learning;
- helping teachers to grow as persons finding rich satisfaction in their interactions with learners.

(Rogers 1983, p. 3 adapted and shortened)

The Student-Centered approach is based on the empirically proved hypothesis (Aspy, 1972) that students achieve superior academic results and even personal growth in terms of higher self-confidence, openness to experience, etc., if they learn in an atmosphere or climate that can be characterized by three basic attitudinal conditions: realness, acceptance, and empathic understanding. These necessary and sufficient conditions must be held or lived by the instructor, better facilitator, and reciprocally be perceived by the students.

- *Realness*, genuineness, or transparency in the facilitator means that he or she must be real in the relationship with his/her student, be the person he/she is and not use any masks of facades in communicating with the students.
- *Acceptance*, prizing, or respect towards student implies that the facilitator accepts and respects the whole personality of the student and feels basic trust in his or her constructive tendency, his/her striving for solutions in his/her own way.

- Deep understanding, often called *empathic understanding*, means that the facilitator actively listens to the students with the ultimate goal to profoundly understand their questions, motivations, intentions, and the meanings of their communication as well as solutions.

Besides the above attitudinal conditions that contribute to establishing a facilitating, fruitful atmosphere for learning, Carl Rogers proposes three more conditions for essential, whole-person learning (Rogers, 1961):

- Significant learning occurs more readily in relation to situations perceived and recognized as problems by those who wish to learn. Students in required courses are apt to view the course as an experience in which he/she expects to remain passive. The essential implication of this observation is that we need to permit students, at any level, to be in real contact with problems they consider relevant, so that they perceive problems and issues they really care about and wish to resolve.

- There exist many resources of knowledge, techniques, of theory, which constitute raw material for use. It seems that these resources be made available to students, not forced upon them. Aside of the usual resources, such as books, maps, tools, materials - both in electronic form or in as hardcopies -, the instructor can be considered as a human resource, who would want to make himself or herself available to his/her class in numerous ways. He would want to let his students know they can call on his knowledge, yet he would not want them to feel they must use him in this way. She would want them to know her own way of thinking about the field, even in lecture form, if they wished. Yet, lecturing should be perceived as an offer rather than a must. He would want the quality of his relationship to the group to be such that feelings could be freely communicated, without becoming a restrictive influence. Thus excitement, enthusiasm, boredom, disinterest, or pleasure of one's own learnings could be shared among all participants of a class. In general, whatever resource the teacher supplies -- she would feel and hope to be perceived as offerings to be used rather than guides or requirements.

- The basic humanistic hypothesis upon which the teacher builds is that students who are in contact with real problems wish to learn, want to grow, seek to find out or desire to create. He/she sees his/her function as that of developing a climate in the class that these tendencies can evolve.

Briefly, Student-Centered Teaching requires particular personal attitudes from the facilitator as well as at least a certain degree of openness from the side of the curriculum as well as the students. From personal experience we'd like to add the requirement on, or at least the benefit of social skills and techniques such as moderation (Freimuth, 2000). These help to make group processes more transparent, to converge faster and hence to improve student satisfaction (Bruffee, 1999). We postpone the discussion of these didactic requirements to the final Section and proceed by comparing Student-Centered Teaching with other didactic methods.

Comparison with other didactic methods

Every didactic method builds upon a theory of learning. Currently, individual approaches tend to be categorized under three mainstreams (Holzinger, 2000):
Behaviorism deals with perceptible data and excludes ideas, emotions, and inner experience. Learning is seen as a pure stimulus-reaction mechanism being based on conditioning. Although pure behaviorism is often criticized, its various forms still prove effective for the acquisition of factual knowledge. This applies despite the fact that human beings play the role of passive "knowledge receptacles" (Skinner, 1974).

Cognitivism defines learning as a procedure of information processing in the human brain, with a close connection to artificial intelligence. The goal is concept learning and problem solving. Teachers are no longer strictly experts but act as tutors who accompany the learners during the learning process and support them in active problem solving. The target of learning is the detection of a problem solving process (How can I find the solution?) rather than the recall of factual knowledge. In this mainstream, the cognitive aspects of the individual are considered, but his or her relationship to the world including other people is not an issue.

In constructivism, the most recent didactic mainstream, learning is considered to be an active knowledge construction process that builds upon knowledge already possessed by the learner. Thus, learning is individual, and learning methods cannot be prescribed. Principally, teachers cannot teach knowledge, but have to take on the role of trainers and coaches who help the learners to acquire knowledge themselves. Important sub-streams are: cognitive apprenticeship, situated learning (in an actual, real learning environment), goal based learning (the use of the learners individual interests) and anchored instruction (with an anchor stimulus at the beginning of a learning process designed to attract attention and create interest). Anchored instruction (Bransford, 1993) is the basis for case based learning (CBL) and problem based learning (PBL) as is, for example, often applied in medical training. In brief, the main goal of constructivism is competence, not knowledge as in cognitivism or achievement as in behaviorism.

Trying to categorize Student-Centered Teaching under one of the mainstreams, constructivism seems to come closest, although the match is by far not complete. Student-Centered Teaching shares with constructivist approaches the theory that knowledge is constructed as the result of problem solving in an authentic, situated environment. Also, interaction is central to the process of problem solving that calls for understanding a complex situation in its entirety. Yet, Student-Centered Teaching is less directed than constructivist approaches. The instructor role is taken over by a facilitator who accompanies rather than leads or coaches students in their personal learning (Holzinger, 1997). Emphasis thereby is on interpersonal values – how can I be supportive here and now – and on providing a climate of trust and openness that can be uses for whole-person learning, involving cognition and feeling, mind and heart of every individual. It is precisely this acceptant climate and balance of cognition and emotion that is made responsible for their synergetic effects leading to deeper, life-long learning experiences (Rogers, 1983, 1991). This phenomenon has also been observed by Roger Schank and expressed in one of his popular phrases as: “We learn best what we feel most” (Schank, 1994; Schank, 1995).

Besides involving whole persons with their opinions, attitudes, cognitions, feelings, and insights into the learning process, Student-Centered Teaching is unique in one further respect. It is the only paradigm explicitly aiming at personal, social, and cognitive growth of the facilitator of learning, resulting in finding rich satisfaction in the interaction with learners and fully appreciating the creative forces of the whole group of which he/she is a part. Since individual learning processes are non-repetitive by their nature, every situation is perceived as unique and has the potential of providing inspiration into delving deeper into it. Boredom and stereotyped repetition, the plagues of traditional teaching, simply do not occur.

Before moving on yet another comparison seems worthwhile. Within the constructivist community, the idea of situated cognition has gained importance and three major approaches have been suggested: Cognitive Flexibility (Spiro, 1990), Cognitive Apprenticeship (Collins, 1989), and Anchored Instruction (CTGV, 1990) In a nutshell, they all seem to apply for Student-Centered Teaching in an extended form, namely addressing the learners' (and facilitators') cognitive as well as inter- and intra-personal levels. Thus, Cognitive Flexibility, meaning the learner shall take on multiple cognitive perspectives shall be extended to the position that learners and particularly the facilitator should be flexible emotionally as well, trying to empathically understand the students' meanings and feelings. More concretely, this would mean to transparently communicate to students some of one's personal feelings in response to their actions, whenever this is considered supportive. For example, the facilitator might genuinely comment on a student's presentation:

> "Your remark about the percentage of project-time wasted as a result of poor communicative skills in project teams addressed me deeply. It confirmed me in my thinking about our responsibilities as facilitators."

At another occasion he/she might let the team know:

> "Frankly, I felt bored by your presentation, it was almost a repetition of the lecture I gave to this group last week! Couldn't you try, from now own, to emphasize the usage of this material *in your own project*?"

Surprisingly, some sensitive openness tends to be enormously effective in improving the learning climate and students tend to appreciate and to mimic that in their reactions.

A similar extension can be suggested for Cognitive Apprenticeship, resulting in the facilitator's role of accompanying every learner not only cognitively, but as a whole person. Let us give a brief example on what we mean by that. The facilitator may comment in acceptance:

> "I see you spent a lot of time for searching for these comprehensive sources and prepare this well-organized overview. Let us see how we can apply some of this in our projects."

Regarding Anchored Instruction we observe that "instruction" in Student-Centered Teaching "naturally" tends to be anchored, although the problems are not necessarily preset by the facilitator but rather selected and elaborated by the students themselves, possibly following some loose preset structure in order to prevent them getting lost in too much

freedom. For example, students may freely choose their project contents as long as they apply the design techniques that are part of the content of the respective course.

Combining Student-Centered Teaching with Internet technology

The Internet and numerous derived technologies are particularly well suited to be used with the Student-Centered approach. This is because, optimally, they provide students with the capability of freely exploring material that is considered relevant for the solution of the tasks they set for themselves, after consultation with the facilitator with and his/her agreement. In SCeL students, supported by their instructor, typically use the Internet in two ways. The first way is to use the Internet as a knowledge source in so far, as students search for relevant knowledge. Thereby they need to actively ask themselves what material might be useful for fulfilling their task and need to assess, which documents, journals, libraries, books, institutions might provide the information they need. Once found, students need to evaluate the sources with respect to their relevance for the solution they seek. Needless to say, all lecture notes and a reading list is provided by the instructor in a downloadable format.

The second way to use the Internet or an eLearning platform in SCeL is as a repository of students' documents as well as a communication medium for discussion with their colleagues as well as the facilitator. Using web-space as a repository for intermediate, partial solutions is particularly helpful in situations in which small teams of students cooperate on the same project. This is because each team member can consult and discuss documents with his/her team mates and also with the facilitator. These same documents can further immediately be used for presentation in those courses that are organized as laboratories. In our case study, we prepared an index page with entries for each team and individual student. Students' emails were also made available. Whereas read access was provided for all students of a course and the facilitator, only the members of each small team had write access to their respective workspace. In order to further improve the communication between students and between students and instructor, a discussion forum can be set up, although in our case it was not widely used.

In brief, New Media can be used to provide resources on an individual basis independent of time and location and further to facilitate communication. Students need to actively engage in and direct their learning process, set expectations and carefully select information they consider useful. An essential point is the students' motivation to use these vast capabilities. This is the point where a supportive and challenging Student-Centered atmosphere plays a major role. If combined properly, synergistic results between experiential- and media supported learning should come quite naturally.

The role of the instructor in the particular setting

The following is a particular adaptation of the facilitator's role and grading procedure used in the case study. Pure Student-Centered teaching dismisses grading whenever possible and aims at open curricula.

- The instructor takes on the role of a facilitator or coach. He or she supports the students in their search and supply of relevant material, coordinates the students' presentations of individual milestones of their projects, moderates discussions, consults in all kinds of problem-solving and seeking for solutions, lectures on topics that are selected in plenary discussions with the students and conform to the curriculum.
- The facilitator suggests topics for lecturing and discussion according to the curriculum, the goals she set for the course in agreement with the students, and according to students' interests. He or she also suggests various options and topics for laboratory work, among which each student can choose.
- The facilitator being responsible that the requirements prescribed by the curriculum be met, he or she takes over the final decision about a positive or negative grade. Otherwise, the criteria for evaluation are open to discussion at the beginning of the each course. In particular, the oral form of exam allows the facilitator to take into account the individual contribution and learning of each student.

Student-Centered eLearning in software engineering – case study

Concrete setting and motivation

In the academic year 2000/2001 Renate Motschnig taught a conventional 3-hour lecture and 2-hour lab course in the area of software engineering in the winter term. In these courses, the focus is on object-oriented concepts, the UML, testing and maintenance. The advanced courses in that area are taught in the summer term and consist of a 1-hour lecture and a 2-hour lab course during a period of four months. The lab course was split into two parallel groups in order to accommodate for the limit of maximum 20 students per course.

In the introductory session the concept of Student-Centered Teaching was presented and the students were asked to fill out a personal questionnaire. It contained questions regarding their interests in the subject area, their expectations on the course, their current job, and a rating on in how far students were satisfied with conventional course formats versus their willingness to participate in the Student-Centered approach. This questionnaire served as an orientation aid for the facilitator and has proved to be indispensable throughout. One interesting result was that students tended to be significantly more interested in trying out the new approach than stick with old teaching habits. This can be seen from the fact that 29 of the 31 students who returned the questionnaire rated the option to stay with a conventional approach with 3.44 on a scale where 1 stands for best and 5 for worst, whereas the option to experiment with the Student-Centered approach was rated with 1.69 on the same scale. Two students did not respond to these two questions.

In the next session, the facilitator briefly presented about 10 topics, two of which she marked as being required to be covered in terms of the curriculum. These were requirements engineering and web design patterns. From the remaining 8 topics students could choose 3-4 to be covered by the course or equally could suggest topics they wished to be dealt with. Students first hesitated for a while, but as the facilitator welcomed new topics they suggested, amongst a few others, web-security. During the selection this topic came to rank on the third place, meaning that it would be covered in the course. This also meant that the facilitator prepared extra lecture notes for this topic. Some students provided valuable inputs such that all in all this enriched the course with a very meaningful topic and, furthermore, strengthened credibility in being Student-Centered.

In the following lecture units, five topics were presented in lecture form in a blocked mode, such as to be available for the accompanying lab classes. Following the students' preferences, key material was presented in lecture form with enhancements and details scheduled for eLearning, letting students choose topics they wished to follow more deeply on an individual basis. Each lecture was held such that at the beginning we had a discussion on the main issues of the previous lecture and the follow up eLearning insights. The students were asked what they found most applicable or most interesting, how they think they could use the material in their work, etc. This part of the "lecture" was particularly enriching for all participants since people discussed freely and enthusiastically about their new insights, gave hints on good web resources and generally broadened the scope of other participants including the facilitator. In fact, learning from peers turned out to be authentic and real and gave every participant the opportunity to contribute and thus feel important in the group. Also, before actually starting lecturing on a topic, students were asked to contribute their existing knowledge or ideas on the topic. Often, there was some overlap with what followed in the lecture, such that the facilitator could point to cross-connections. This made the material appear less theoretic. Also, sometimes we tried to fit students' inputs into the existing theories that again brought some valuable insights.

In each of the two parallel lab courses, students were encouraged to build teams of 2-4 persons. This is because on the one hand it would be hard to individually handle 15 – 20 people, on the other hand students could experience working in small, self-managed teams and use the Internet for communication and cooperation. The students were presented with a list of 15 freely formulated topics from which they could choose their project. One of the topics said "any other topic you like subject to being discussed with the facilitator". In this way the students were given much of the freedom in the spirit of the Student-Centered approach, yet, by making suggestions, the facilitator took care not to let her students be lost in complete freedom that they were not used to from their previous learning experience. In order to get a view on the students' engagement with the course material and their work styles, each student was instructed to document the time and activities he/she spent with the project in the form of a project diary that had to be handed over to the facilitator in the course of the final exam. During the weekly lab sessions with the large group the small teams presented their intermediate results and the personal resources of the large group were used to support individual tasks in the "here and now". For example, we applied some of the requirements engineering techniques to specific projects according to the students' choice. For example, we performed a goal analysis for a web-based system that was to manage further education of a company's employees, or we

brainstormed about the requirements and criteria of a good web-editor. The brainstorming was a unique experience in that we used a video-beamer to record the individual items electronically in a text document. It proved particularly fast and effective since the initial list was uploaded on the web and could still be expanded, before the responsible team structured it and, in a follow up session the large group suggested priorities for individual requirements. As another example, we captured use-cases (i.e. scenarios) for a web-application for a karate-club, or acquired the non-functional requirements for web-editors. Throughout the term, students volunteered in presenting intermediate milestones of their projects that were then discussed by the whole group. It should be emphasized that the last 15 minutes of each lab-session was scheduled for individual questions. This time was primarily spent for the exchange of material that was not available on the web or for the students' consulting on what to do next. Also, quite heavy email traffic took place between the students and the facilitator, mainly for reasons of the exchange of material.

From our experience it is appears that SCeL courses still take more of the facilitator's time than conventional ones but the overhead, in our case, is clearly outweighed by the intellectual, social, and personal gains of the respective courses. Moreover, we conjecture that increased experience with the new style will reduce some further fraction of the overhead.

Some of the benefits of SCeL we experienced are the following:

- A rich choice of material can be made available to all quite easily.
- The Internet can be used for exploratory learning such that students search for material and choose and comment on resources they find most useful.
- Group workspaces for small teams can be provided such that students working in small groups can exchange and update documents independent of time and location.
- Knowledge can be constructed incrementally, both in face-to-face and online phases.
- In as much as the computer takes over essential parts of the transfer of intellectual knowledge, time can be spent to learn from the different and overlapping viewpoints of peers. Thus, social and personal learning are facilitated.
- Students who feel respected and understood tend to be more open, cooperative, constructive, acceptant and responsible themselves.
- Students can learn from multiple examples rather than just from a single one.
- Various and individual proofs of learning are a lot more feasible. Also, mixed modes of evaluation including self- peer- and instructor's evaluation are quite easy to adopt.
- Students who tend to be quiet and less expressive in face-to-face discussions often participate more actively in online activities that give them time to think before responding.
- Students tend to be more active taking on different roles, such as document author, team mate, coordinator, enquirer, evaluator, recorder, etc.

Evaluation

In one of the final sessions the courses were evaluated by employing two questionnaires. The standard, but extendible, questionnaire was supplied by the University of Vienna, a special questionnaire was developed by the author following the format suggested by David Aspy and Flora Roebuck in (Aspy, 1972). The standard questionnaire has been extended to include a question on whether the students found it worthwhile to use the Internet. Most interestingly, this question was unanimously answered highly positively. It got the best grade by all students. The main goal of the special questionnaire was to assess the facilitator's attitudes along the dimensions of realness, acceptance, and understanding, and furthermore his/her general attitude towards question answering. As can be seen from Figure 1, these dimensions were ranked on a scale form 1 (worst) to 5 (best). According to (Rogers, 1983), level three is the minimally effective threshold on interpersonal attitudes (the mean value from the three specific attitudes) for Student-Centered Teaching to become effective. A survey among about 1200 teachers in various locations in the USA showed that teachers not trained in humanistic education ranged slightly below three. As a consequence, we conjecture that training in interpersonal attitudes is essential for Student-Centered Teaching and, in our case, for SCeL to become fully effective. In the case study, the facilitator's rating on interpersonal attitudes according to the questionnaire given in Figure 1 led to the results given in Figure 2, whereby the results stem from students in two parallel groups on software engineering (requirements engineering and web-design) and on project management, respectively.

Grading

Regarding the grading of students, the lab courses were evaluated in a final 30-minute interview and presentation with each individual team. They presented their final results, described the way the team split its responsibilities, and handed over the project diary. The facilitator also asked the students about their personal learning. This point turned out to be particularly exciting, since it touched points that the facilitator would never foresee, such as setting up a web-server, interviewing an expert-user of a web-editor, working through a tutorial on the Unified Process in order to determine milestones etc.

The grading regarding the whole field of software engineering is done in two parts, a written and an oral one, in order to cover the full spectrum of a student's learning: Whereas the written part is designed to objectively address the basic material from the conventional 3-hour lecture, the oral part gives the facilitator the opportunity to enquire about the learning that occurred during the students' subjective, experiential learning as a result of the advanced course in SCeL format. Alternatively or in addition, project results made available on the Internet could be peer evaluated, as we intend to do in the next iteration. Since these combinations of evaluation strategies are pretty well consistent with the conventional way of performing exams, it makes it easy to enrich conventional curricula with the SCeL style.

Results from the case study

Students' view.

- Students feel they have learned much, definitely more than in conventional courses having the same length.
- Students know what they would improve on what aspect of their work if it were continued.
- Students find they enjoyed the course and even had some satisfaction and fun in doing their projects.
- Students know to which areas they are going to apply the knowledge and skills they have learned.
- Students tend to deliver the project diary as a whole team, occasionally mentioning some individual work.
- Students unanimously are in favor of using the Internet, they wish to have more rights and opportunities to execute their programs and they wish better technical support in using the web.
- Some students are interested in the psychological and didactic foundations of the Student-Centered approach.
- Students in general wish to attend and enquire about further courses by the same facilitator.

Facilitator's view.

- Students tend to spend significantly more time for their projects that in comparable, conventional courses.
- Students solve several problems, primarily technical ones, on their own.
- The majority of the results are better than in conventional courses, some are about the same. The latter tends to be the case if students have too tight schedules. They explicitly take initiative in mentioning this as an excuse.
- Students tend to drop out at the very beginning, but constantly stay assigned after the initial period of about three weeks.
- More students attend the lectures and fewer students stay absent from the lab course compared with conventional teaching.
- Students moderately engage in discussion with other teams, the vast majority succeeds in managing and distributing their work in their own small team, based on individual skills and knowledge.
- Students tend to underestimate rather than overestimate their achievements when asked to suggest a grade for themselves. They are very surprised by that question and find it particularly hard to respond.
- The SCeL approach is more time consuming than a conventional course also from the facilitator's point of view and it requires more communication throughout the term. Special lecture notes need to be prepared and made available on the Internet.
- The SCeL approach leads to good interpersonal relationships with the students.
- Real sharing of ideas is possible. It allows for a more extensional perception of questions of interest.
- Facilitators need a variety of skills beyond those of lecturers and also beyond those of facilitators of encounter groups! They need to be able to lead a group to some goal, to activate students, to facilitate discussions, to

visualize results from problem-solving processes of any kind and to know the basic media-technology from a user point of view. They also need to “know” when and how to shift between their multiple roles transparently. Consequently, a new term seems to be needed to distinguish their role-responsibilities. Recently, the term "*coach*" has been introduced in a similar context and seems to be well suited to express a function that is both accompanying and orientation-providing.

The SCeL approach, by its very nature, is unique in each course, even in parallel groups of the same course. It is experienced as personally highly enriching by the facilitator. The fact to be with the students and participate in their striving for solutions adds much to the personal values of the facilitator as well as to his/her inspirations for further work.

Students’ final comments

Finally, we include some comments that we present in the students’ own words:

- One student writes: “ In comparison with a course at the university of technology, in this course I have really learned something. Often, I had a lot of stress due to the required effort, but it was worth it. There were interesting topics, many of which do not have sufficient room in our study. More non-compulsory courses with similar topics could be foreseen. Questions form the point of view of informatics should be addresses more intensively, the course is more strongly oriented to business informatics.”
- Another student’s comment after the final course-unit. “In sum, this course was very interesting. I liked the weekly team presentations that should address the whole group. I learned much from this experience. I would wish to have more time for finalizing the project.”
- Now a brief, critical comment: “The time for the final implementation was much too short!”
- Another rather critical feedback: “It would be better, if individual teams communicated more and discussed more actively.”
- Finally a more positive viewpoint: ”I find this course and the concurrent lab-course very useful. I have learned a lot personally. The whole atmosphere and the facilitator’s reactions very distinctly interesting for me!”

A General attitude:
The facilitator responds:
1 in a destructive, de-motivating way
2 ineffectively, presumptuously
3 minimally effectively
4 in a way that notably supports making progress
5 in an encouraging, supportive way that significantly contributes to making progress

B Realness
The facilitator
1 avoids questions, in not accessible and refuses open conversation
2 hides between his/her position and it is difficult to transparently communicate with him/her
3 gives clear answers to some minor degree
4 tends to communicate openly and transparently
5 communicates totally transparently, gives frank responses and is perceived as genuine and real

C Acceptance
The facilitator
1 meets students without any respect, does not consider their requests
2 hardly respects the students' requests and demands
3 respects the students' needs and requests to some minor degree
4 is generally respectful towards students and encourages them
5 is friendly, full of trust in students, encourages them, and lets them perceive his/her respect

D Understanding
The facilitator
1 completely ignores the students' needs
2 hardly responds to the students' needs and interests
3 to a minor degree reacts to what the students communicate
4 often reacts to what the students say such that they feel understood
5 completely understands the students' needs and interests, reacts to students in a supportive way.

Figure 1: Questionnaire for assessing a facilitator's attitudinal conditions in the Student-Centered approach.

Course	General	Realness	Acceptance	Understanding
SWENG 1, N = 12	4.5	4.66	4.9	4.5
SWENG 2, N = 9	4.5	4.77	4.66	4.5
IT-PM N = 11	4.0	4.54	4.4	4.2
IT-PM N = 6	4.16	4.5	4.5	4.5

Figure 2: Results from assessing the facilitator's attitudinal conditions in two parallel software engineering and IT-project management courses.

Discussion and Conclusions

Despite the generally enriching experience Renate Motschnig made in conducting the case study, some words of caution are in place. These stem from the very personal experience by the author and are not necessarily shared by the promoters of Student-Centered Teaching. This is primarily because they promote and build on preconditions that would require vast changes of university curricula that the author, in her current belief and position, does not consider realistic in the short run. Furthermore, she prefers an incremental, evolutionary, experiential process to assess the merits of the new paradigm. In this context let us return to the question under what circumstances we conjecture Student-Centered Teaching to be most effective. We first deal with Student-Centered Teaching in general and then consider arguments concerning its combination with New Media.

- We have observed that Student-Centered Teaching requires much interaction between students and facilitators. Thus, in the form presented here, it can be suggested only for rather small groups, say up to 25 students. Experiments with larger groups (Chase & Geldenhuys, 2001) would be required to test this criterion.
- Students should already have some background on the subject upon which they can build, in order not to get lost in a new area. In this respect, good background knowledge, say from some more traditional introductory course, helps to broaden and deepen experiential findings in a focused way, as is required by our conventional curricula.
- Speaking from experience, it is essential that facilitators or coaches have broad and deep knowledge in the courses' subject area in order to provide really effective support and to gain personally. It is an open and, in our view practically and theoretically interesting question what would be the result if SCeL were used in facilitating courses not precisely meeting this criterion.

Before discussing the contribution of New Media to Student-Centered Teaching it should not remain unsaid that Rogers himself is well known as a pioneer in using most recent technology as a tool for learning as well as research. His recorded interviews and sessions have become world-famous. Hence, the adaptation of SCT to employ new technology can be seen to follow the spirit of Rogers and thus appears particularly worthwhile and legitimate from a cultural viewpoint.

- Due to the fact that relatively much time, both from students as well as the facilitator is spent on the search and exchange of material, the Student-Centered approach significantly benefits in terms of efficiency and effectiveness, if all or most of the relevant material (even better a superset of the material required for a course) is
    - available electronically, and
    - well structured, such as to be found and examined for relevance easily (Motschnig-Pitrik, 1990).
- Since eLearning environments and authoring tools strive to meet these requirements, they seem to be primary candidates to be combined with the SC approach for improving its effectiveness.

- Needless to say, using New Media effectively requires some basic skills that should be owned by facilitators and students.
- Given that in SCT it are the students who shall stay in the control of their learning processes (within the limits of a curriculum), New Media provide more facilities to support individuality and initiative or active control than conventional ones. Active searches, interactive environments, student- or facilitator-initiated electronic dialogues (Wenger, 1998) are just a few means to accomplish this (McConnell, 2002).

To close the discussion of criteria on Student-Centered Teaching, perhaps most important is that the facilitator or coach hold and communicate the three attitudinal conditions, namely realness, acceptance, and understanding (Rogers, 1961; 1983). In that respect, a particular personality structure is required that needs to mach the personal attitudes and values of the coach. For persons who feel comfortable with the attitudinal conditions required by the approach, reading material complemented by training in the form of encounter groups and workshops can be provided to develop higher levels of these interpersonal values and thereby make the approach more effective. Personally, the authors believe that the attitudinal conditions or interpersonal values (Aspy,1972) should constitute the congruent, stable foundation on top of which social and communication skills be built. In particular, a good coach needs skills to pose good questions, activate students, mediate discussions, visualize the results of group processes, act according to the group's feeling or thinking about a situation, and transparently shift between his/her multiple roles (Rogers, 1983; Freimuth, 2000).

Further research and applications will tighten the integration of eLearning platforms and face-to-face meetings in order to get the best of each style (Motschnig-Pitrik & Derntl, 2002). We further intend to apply SCeL in other advanced courses and to sensitively and iteratively introduce some features of it in courses for beginners. Further case studies will extensively work with reaction sheets to be delivered after each major block and will test for changes in the students' non-verbal self concept. We also intend to develop and start to pursue strategies for introducing SCeL in other courses at the department of computer science and business informatics as well as the department of psychology at the University of Vienna. In Graz, SCeL will be adopted in the context of the virtual medical campus (vmc.uni-graz.at). At both universities, staff development for SCeL is still an open issue and it appears difficult to find funding for this essential issue.

Summarizing, the case study has shown that the emerging style requires qualifications and social skills being very different from those needed for conventional teaching. Interestingly, it appeared that New Media could extremely well be employed to support the coach of facilitator in numerous ways being particularly relevant to the Student-Centered approach. This is because New Media have the potential of reducing the overhead required for the provision of a broad choice of resources being typical for SCeL, as well as for the organization of communication and collaboration that both appear essential in SCeL. Also, the use of New Media allows less eloquent or less expressive students to actively contribute in on-line knowledge construction (McConell, 2002). Acknowledging that New Media open up vast knowledge sources, allow students to explore and follow their particular interests, provide means for focused communication, and are available around the clock, leads us to hypothesize that they optimally

support learning processes that are directed by the students and just initiated and channeled by coaches. Vice versa, if the delivery of information can be supported by the use of advanced information and communication technology, social and personal learning gain in importance. In this respect, Person-Centered principles already have proven to be most effective. Consequently, in the authors' view, the present is optimally suited to bring together Student-Centered Teaching and New Media in order to ensure effectiveness while equipping teaching and learning with more and life-long personal meaning.

References

Aspy, D. N. (1972). *Toward a Technology for Humanizing Education.* Champaign (IL): Research Press Company.

Baxter, S., & Gray, C. (2001). The application of student-centred learning approaches to clinical education. *International Journal of Language & Communication Disorders / Royal College of Speech & Language Therapists, 36*(Supplement), 396-400.

Bransford, J. D. (1990). Anchored instruction: Why we need it and how technology can help. In D. Nix & R. Spiro (Eds.), *Cognition, education and multimedia*. Hillsdale (NJ): Erlbaum.

Bruffee, K. A. (1999). *Collaborative Learning. Higher education, interdependence, and the authority of knowledge*. Baltimore: Johns Hopkins University Press.

Carlile, S., Barnet, S., Sefton, A., & Uther, J. (1998). Medical problem based learning supported by intranet technology: a natural student centred approach. *International Journal of Medical Informatics, 50*(1-3), 225-233.

Chase, C. C., & Geldenhuys, K. M. (2001). Student-centred teaching in a large heterogeneous class. *Medical Education, 35*(11), 1071.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 453-494). Hillsdale (NJ): Erlbaum.

CTGV. (1990). Cognition and Technology Group at Vanderbilt: Anchored instruction and its relationship to situated cognition; , 19, 2 - 10. *Educational Researcher, 19*, 2-10.

Freimuth, J. (2000). *Moderation in der Hochschule: Konzepte und Erfahrungen in der Hochschullehre und Hochschulentwicklung*. Hamburg: Windmühle.

Gamboa, R., F., Perez, S., J. L., Lara, R., F., Caviedes, C., F., & Miranda, V., A. I. (2001). A student centered methodology for the development of a physics video based laboratory. *Interacting with Computers, 13*(5), 527-548.

Glew, R. H. (1994). Student-centered curriculum teaches more than pathophysiology. *JAMA: the Journal of the American Medical Association, 272*(9), 743.

Holzinger, A. (1997). Computer-aided Mathematics Instruction with Mathematica 3.0. *Mathematica in Education and Research, 6*(4), 37-40.

Holzinger, A. (2002a). *Multimedia Basics, Volume 2: Learning. Cognitive Fundamentals of Multimedial Information Systems*. New Delhi: Laxmi Publications.

Holzinger, A. (2002b). *Multimedia Basics. Volume 1: Technology. Technological Fundamentals of Multimedial Information Systems.* New Delhi: Laxmi.

Howe, A. (2001). Patient-centred medicine through student-centred teaching: a student perspective on the key impacts of community- based learning in undergraduate medical education. *Medical Education, 35*(7), 666-672.

Jones, R., Higgs, R., de Angelis, C., & Prideaux, D. (2001). Changing face of medical curricula. *The Lancet, 357*(9257), 699-703.

McConell, D. (2002, April 2002). *Negotiation, identity and knowledge in e-learning communities.* Paper presented at the 3rd International Conference on Networked Learning (NLC 2002), Sheffield (UK).

Motschnig-Pitrik, R. (1990). A Framework for the Support of a Common Structural Level for Software-, Database-, and Knowledge Based Systems, *The Journal of Systems and Software*, North Holland, Vol.12, No.2, pp. 125-137.

Motschnig-Pitrik, R., Derntl, M. (2002). Student-Centered eLearning (SCeL): Concept and application in a students' project on supporting learning. In *Proc. of ICL 2002, International Workshop on Interactive Computer-Aided Learning*, Villach, Austria, Sept. 2002.

Rogers, C. R. (1961). *On Becoming A Person - A Psychotherapists View of Psychotherapy*. London: Constable.

Rogers, C. R. (1983). *Freedom to Learn for the 80's*. New York: Charles E. Merrill Publishing Company, A Bell & Howell Company.

Ryback, D. (1998). *Putting Emotional Intelligence to Work*. Boston (MA) et.al.: Butterworth-Heinemann.

Sanderson, P. E. (2002). E-Learning: strategies for delivering knowledge in the digital age. *The Internet and Higher Education, 5*(2), 185-188.

Schank, R. C. (1994). Active learning through multimedia. *IEEE Multimedia, 1*(1), 69-78.

Schank, R. C. (1995). *Engines for Education*. Hillsdale (NJ): Erlbaum.

Skinner, B. F. (1974). *About Behaviourism*. London: Jonathan Cape.

Spiro, R. J., & Jehng, J. (1990). Cognitive flexibility and hypertext: Theory and technology for the non-linear and multidimensional traversal of complexsubject matter. Cognition, Education, and Multimedia. In D. Nix & R. Spiro (Eds.), *Cognition, Education, and Multimedia*. Hillsdale (NJ): Erlbaum.