Considering the Human in Multimedia: Learner-Centered Design (LCD) & Person-Centered e-Learning (PCeL)

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Abstract: Multi-medial learning material must be both usable and appealing to the learner in order to attract their attention. In any case, it is the learning outcome that is the primary indicator of the quality of learning material. To achieve high learning outcomes we suggest that the instructional material should be based on Learner-Centered design (LCD) principles and be integrated into a Person-Centered e-Learning (PCeL) process and atmosphere. Briefly, LCD applies principles of Human-Computer Interaction (HCI) and Usability Engineering to the design and development of e-Learning material, according to the specific needs of learners. Similar to User-Centered Design (UCD), LCD provides cues for motivation, focuses on the tasks and goals of the learners, and helps them to develop as they use the material. In PCeL, the primary role of the computer is to take over a major share in the provision of information. This leaves room for the creation and deepening of meaning through transparent, open, respectful and empathic interactions in face-to-face meetings. In this paper we propose an integrated approach that uses LCD-driven e-Content with PCeL attitudes and processes.

"The challenge for HCI these days is supporting individuals in developing expertise in their professions, in developing richer and deeper understandings of content and practices." Soloway, Guzdial & Hay (1994) [1].

1. Introduction

Multi-medial material for the use of online learning is often stored in so called Learning Objects. The principle of a **Learning object (LO)** is historically grounded in the object-oriented paradigm of computer science. Object-orientation basically values the creation of components (called "objects") that can be reused [2], [3], [4, 5]. Generally a LO is defined as *a granular, reusable chunk of information that is media independent.* The term **information chunk** reaches back to Miller (1956) [6]; In the sense of Miller a chunk is an information unit, which can be perceived at one time by

the individual into the short term memory (STM); Chunks are generally information units which can be individually complex and intra-individually very different [7].

Generally also the term "media object" is often used and for the purpose of e-Learning such an object is further defined as *"digital media designed and/or used for instructional purposes [8]"*. Such objects range from simple text, over video demonstrations up to interactive multi-medial simulations. However, the main requirements which a LO must fulfill include interoperability and reusability:

Interoperability is the capability to use and exchange information via standardized formats. This can be provided through the use of *metadata* such as IEEE Learning Objects Metadata (LOM) and the Shareable Content Object Reference Model (SCORM) [9], [10].

Reusability is the ability to use the LO again, i.e. to reuse it within another context. A central approach to reach these requirements is modularization, also a paradigm of computer science. However, a complete LO must include far more than certain technological properties only: It must be designed *learner-centered* and it must make use of a *didactical model.*

In this paper we discuss these two issues: Designing a learning object by following the approach of Learner-Centered Design (LCD) and using it within a didactical setting which we call Person-Centered e-Learning (PCeL).

2. From Usability to User Centered Design

2.1. Usability

At the outset we wish the reader to notice that the main goals of usability meet exactly the attributes that well designed learning material should comprise (Nielsen, 1993), (Nielsen and Levy, 1994), (Nielsen, 1996):

- *Learnability* (ease of learning, especially for novice users; we can benchmark this by measuring the time to perform certain tasks).
- *Efficiency* (high level of productivity for expert users; we can benchmark this either by measuring productivity or by task performance).
- *Memorability* (high accessibility for infrequent users; we can benchmark this by measuring the time required to perform tasks when users were away from the system for a certain period).
- *Fault-Tolerability* (low error rate for all users; we can benchmark this by the counting of errors – from minor up to major - made by users whilst performing specific tasks).
- *Satisfaction* (pleasant to use for all users; we can benchmark this by asking users' subjective opinion after performing real life tasks).

2.2. User Centered Design

The growth of the increasingly popular User Centered Design (UCD) approach [11], [12], [13] has occurred in parallel with the focus on the end-user. UCD is an approach to creating environments and products that are usable by the end-users to the greatest extent possible [14]. Whereas System Centered Design addresses questions including: What can be built on this platform? What can I create from the tools available? What do I as a developer find interesting to work on? User Centered Design is totally based upon the end-user's abilities and needs, context, work and tasks. For example, within Software Engineering good user interface design is a complex undertaking, however, encompassing many tasks undertaken in a partly parallel, partly serial, partly iterative sequence that includes planning, research, analyzing, designing, implementing, evaluating, documenting, training, and recycling or replacing [15].

Aaron Marcus [16] emphasizes that, like software development, user interface design usually focuses on the synthesis stages, and user interface components include metaphors, mental models, navigation, interaction, and appearance. UCD methods include understanding the end-users and analyzing their tasks, setting measurable goals, and involving the end-users from the project's beginning [17]. The normative perspective of UCD is that there is *no average end-user* and, consequently, design should be targeted towards specific end-user groups [18]. One of the problems is that traditional UCD does not cope well with a large variety of end-users.

3. Principles and Process in Learner Centered Design

The basic issues of LCD evolved from theories of constructivism [19], [20], [21] and Problem-Based Learning [22]. The central idea of LCD is to put the learners into the foreground, which means to involve them into the learning activity and focusing education to realistic, intrinsically motivating problems. Students should work by themselves to solve these problems, often in pairs or groups. However, the responsibility of the teachers is now to carefully **structure the learning material** [23].

In general, learner-center design must follow three principles:

- *Enabling* the learner's understanding (e.g. strengthened throughstructuring, coaching, critiquing etc.);
- *sustaining* motivation [24] (e.g. through low-overhead and immediate successes or putting learning into the context of doing);
- *offering* of a diversity of learning resources (e.g. using different media and different tools);

Similar to User Centered Design (UCD), Learner Centered Design (LCD) focuses on the tasks and goals of the learners. Soloway, Guzdial & Hay (1994) [1] proposed that a LCD process must focus on three things:

- the *tasks* learners must undertake;
- the *tools* they can use to deal with those tasks; and
- the *interfaces* for those tools.

To prepare learning material in the sense of LCD, we propose to follow the following design steps, which we apply mainly from the UCD approach.

4. Steps in Learner Centered Design

According to figure 1 we distinguish three levels consisting of four phases each.

4.1. Level I: Requirements Analysis & Specification: Know thy end-users!

It is of vital importance to know the needs of the targeted end-users at first [25]. Try to answer the questions: Who? What? Why? Where? When?

During audience analysis some common dimensions include:

- Role: dominant persona of end-users;
- Goals: reason for the interaction;
- Motivational background;
- Circumstances of use (setting, resources, strategy, timing etc.);
- Culture (group level, language, preferences);
- Ergonomics (relevant perceptual abilities, skills etc.); and
- Previous knowledge.

According to figure 1 we can determine four phases:

A) Identify learners and analyze learning requirements (demands, needs, pre-knowledge etc.);
B) Define the learning outcomes;
C) Define context;
D) Define content;

Participants within this phase should include: learners, the teacher (usually domain expert), a multimedia expert (usually a software freak), a design expert (usually a Usability engineer); and a didactical expert. Sometimes these will be reduced to learners, teachers (domain expert and didactical expert) and engineer (multimedia and design expert). It is seldom the case that a person includes all expertise in one.

4.2. Level II: Multimedia Application Design

At this level the focus should be on presentation, access and engagement. According to figure 1 we can again determine four phases:

A) Select appropriate didactical model (for example SCeL);
B) Follow pedagogical design guidelines (Pedagogy, Instructional Design);
C) Follow principal design guidelines (Information Design);
D) Select proper Interactions (Interaction Design);

Participants within this phase should include the same people as in level I.

4.3. Level III: Inspect Prototypes

At the 3rd level the focus should be on usability engineering. According to figure 1 we can again determine four phases:

A) Prototype and implement design from level II;
B) Apply current technology (media; metadata etc.);
C) Check against guidelines;
D) Check with a learning expert and/or with a peer domain expert.

Participants within this phase should include the same people as in level II.

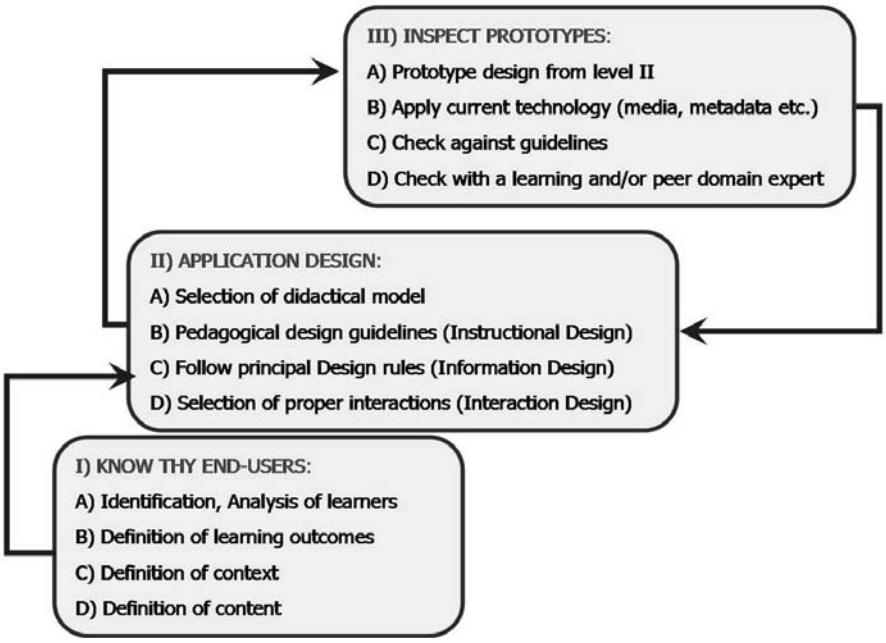

Fig. 1 The design steps following a LCD

5. Person-Centered e-Learning

> *The only man who is educated is the man who has learned how to learn […] how to adapt and change […]. Changingness, a reliance on process rather than upon static knowledge, is the only thing that makes any sense as a goal for education in the modern world. […] When I have been able to transform a group into a community of learners, then the excitement has been almost beyond belief. To free curiosity; to permit individuals to go charging off in new directions dictated by their own interests; to unleash the sense of inquiry; to open everything to questioning and exploration; to recognize that everything is in process of change – here is an experience I can never forget."* [26], p.304

Person-Centered e-learning (PCeL) is a form of *blended learning* in which the computer takes over a major part of the *transmission of information,* while face-to-face phases serve to co-create meaning, develop social and communication skills, and shape interpersonal attitudes. The didactic baseline follows Carl Rogers' Person Centered Approach [27], technological support provides modular, user-centered open source components. The primary goal underlying PCeL is to achieve significant learning.

In Carl Rogers' terms: *„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."* [28], p.20.

Since **significant learning** addresses the particular *needs* of the learner – in the sense of HCI it is highly *learner centered.* At the same time, significant learning emphasizes the interpersonal relationship between the facilitator and the learner who, in the very first place are real persons. This emphasis on relational attitudes rather than roles and the acknowledgement of the facilitator as a resourceful person in the learning process is the primary reason why we refer to the didactic approach as being *person-centered* rather than (just) learner centered.

The basic hypothesis underlying Person-Centered Teaching/Learning can be stated as follows [29]:

Human beings are constructive in nature and strive to actualize and expand their experiencing organism. According to Rogers' Theory of Personality and Behavior [18] the constructive tendency can unfold itself best in a climate that is characterized by three attitudinal conditions, known as Rogers' variables:

- *Realness*, with synonyms such as congruence, transparency, genuineness, authenticity;
- *Acceptance*, else referred to as respect, unconditional positive regard, caring attitude, concern for the individual;
- *Empathic understanding*, a deep form of understanding of the meanings as well as feelings of the learner.

These must be held or lived by the facilitator and communicated to the learners such that they actually can perceive them.

Our research at the University of Vienna, Department of Computer Science and Business Informatics focuses on integrating Rogers' Theory and experience with modern technology [33]. In other words, we aim to enrich Person-Centered Learning with the use of New Media in order to make the whole approach more effective.

From experience we know that Person-Centered Teaching is more demanding on facilitator's time than conventional courses that can be prepared once and reused several times. Regarding efficiency, we hypothesize, hope, and, to some degree experience that New Media, in particular the Internet, can be employed to reduce some of the overhead caused by the Person-Centered style. This is because the provision and distribution of material, including artifacts produced by students, is easier with information and communication technology. Also communication, in particular concerning organizational aspects, can be handled more efficiently.

In typical learning situations such as those appearing in university courses[1] it is further essential that students can solve authentic problems in which they are interested personally [27], [28]. In more recent terminology this principle has been called *anchored instruction* and/or *situated cognition*, whereby we wish to extend the latter term to be *situated learning,* involving cognition, skills, and attitudes.

According to Rogers, humans have a natural predisposition to learn; in this sense the role of the teacher is to *facilitate* such learning, including the clarification of the purpose of the learning and the organization and arranging of learning resources [28]. This is in close accordance to the principle of *scaffolding,* which is a well-known technique for providing support to learners whilst they are learning a new task [30] and is also an important issue of HCI [31], [32].

Whilst the positive effects of the *pure* Person-Centered approach have been proved in a number of case-studies and are well-documented in the literature, e.g. [27], [28], [33] its combination with the Internet as a resource for acquiring knowledge and as a medium for supporting communication is a novel asset [35]. In our experience, PCeL is particularly well suited to support, small teams of students who cooperate on a project each by contributing his/her special knowledge and skills. These groups and their members can follow their individual work styles, meet in class for making strategic decisions, stay in their preferred locations and work environments while completing their project tasks and nevertheless share documents freely on the web such as to stay up to date in their cooperative work.

[1] Note that while Person-Centered Teaching has been applied to several different learning situations, Rogers himself [27] found it most effective in advanced courses with fewer students.

Some of the blended learning elements with which we have had good experience are:

- Online learning contracts for teams of students;
- Online gathering of students' expectations and learning goals;
- Online gathering of ideas on various subjects and subsequent discussion of results in class;
- Team projects with pre-designed milestones;
- Employing checklists and partner teams for project feedback, both face-to-face and online;
- Online reaction sheets that are submitted after a course unit and discussed in the following meeting;
- Online peer-evaluation of projects or documents.

The following are frequent students' reactions in response to the PCeL style:

- Students feel they have learned much, surely more than in conventional courses;
- Students know what they would improve on what aspect of their work if it were to continue;
- Individual students initially are confused by being given much freedom and wish more structure. If this need is respected by the instructor they tend to be fast in adopting to a style in which they gradually make use of the space offered to them;
- 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 (of Computer Science and Business Administration) tend to be in favor of using the Internet in several ways: As a resource, as an active means of archiving and maintaining documents, and for communication purposes. Nevertheless, online communication tends to be viewed only as a supplement to meeting face-to-face;
- Some students are interested in the psychological and didactic foundations of the Person-Centered Approach;
- Students in general wish to attend and enquire about further courses by the same facilitator. Some wish the course to continue.

From the pragmatic point of view, we have implemented PCeL in advanced, practical courses on project management, web engineering, and person-centered communication at the University of Vienna. Furthermore, we have investigated both qualitative and empirical means of evaluation. In a nutshell, whereas students' reaction sheets provided a vivid picture of how the courses were conceived, some initial empirical analysis showed, amongst others, the superiority of the Person-Centered style in bringing about a learning climate that is appreciated by the students and in which the students' interest in the subject matter increases.

Also, we have clearly experienced and objectified by initial quantitative data that technology support alone does not make a difference in students' motivation if it is not matched by interpersonal dispositions of the facilitator(s) [34]. It has proved essential that we introduced the PCeL style in a stepwise fashion, having moved step by step in providing more freedom for students as well as employing e-learning technology. Interested readers are referred to http://elearn.pri.univie.ac.at/pca for many more experiences, research results and possibilities for online discussion.

6. Conclusion and Future Work

Within our teaching experience we noticed that there are some issues that impede students in their work with multi-medial online-material. Some included: Download delays, Downloading millions of plug-ins, having to change fonts or other settings, having to reboot after every session, long scrolling text (students do not like to read on screens), getting lost, no on-line moderator, no instructor available, and most of all: unnecessary distractions (flashing, popping etc.). As a consequence, we suggest that multi-medial material be designed to be simple, useful and usable for the end-users, in other words *learner centered.*

However, preparing using LCD methods is *only the first step;* the second step is to *use the material in an appropriate didactical setting.* In this context, Person-Centered e-Learning (PCeL) proved to be effective and the vast majority of students resonated positively to this strongly participatory, truly interactive style. Person-Centered e-Learning aims to enrich traditional courses by addressing learners at three levels: intellectual, social skills, and personality and intuition. Thereby, technology is employed to take over a significant part of building knowledge at the level of intellect, thereby providing room for addressing the social and personal levels during face-to-face phases. Experience [35], [36] has shown the benefits of the PCeL style in creating a learning climate in which the students' motivation by the course style and their interest in the subject can be increased. However, we wish the readers to appreciate that technology support alone does not do the job, if it is not matched by interpersonal dispositions of teachers or facilitators such as genuineness, respect, and deep understanding.

Further research addresses three directions: the conceptual modeling of some of the general PCeL elements in the form of PCeL Patterns [36] and typical compositions thereof with the goal to support them with appropriate web-design elements. With this we aim to provide general web-templates that further support and simplify the organization, communication and evaluation of courses in PCeL style. Second, we continue to make case studies of courses we facilitate in PCeL style. Third, we intend to integrate e-content adhering to LCD principles into PCeL courses in order to orient blended learning still closer to the learner.

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