Using ePortfolios Enhancing for Learning through Computer-Mediated Interaction in a Course on HCI

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Abstract. Web-services have established their role as facilitating tools for interactive and collaborative learning that supports social knowledge construction. In particular, ePortfolios are gaining importance in supporting the learning process and students' reflection. This motivated us to introduce and investigate an interactive mode in an academic course on Human–Computer Interaction (HCI) that adopted ePortfolio or diary-services, interactive spaces for team projects, and personal as well as interpersonal reflection. The qualitative content analysis of the ePortfolio entries illuminates those aspects in the learning process that were unique due to the computer-mediated interaction offerings in the course.

Keywords: Teaching Human–Computer Interaction and Psychology, ePortfolios, online reflection, online diaries, qualitative content analysis, assessment.

1 Introduction

The ePortfolio (electronic portfolio) is currently revolutionizing the world of learning [1] [2]. Particularly in the education sector, there are many initiatives in order to achieve the European goal "ePortfolio for all" by 2010. ePortfolios shall play the role of the lifelong learning companion that facilitates meaningful, self-directed and autonomous learning, capturing learning experiences, and planning personalized learning paths and careers.

In this study, we investigate the use of ePortfolios in an academic course on Human-Computer Interaction and Psychology (HCI and Psychology). The ePortfolio was part of the so-called "interactive mode" of the lecture which aimed to increase (compared to a conventional lecture) freedom, responsibility, awareness of students own learning, and decreases student's dependence on formal exams. This follows our strategy of applying/living humanistic and in particular person-centered principles within Technology enhanced Learning (TEL) [3] [4] [5] [6] [7]. Supplementary to a team-project, students were asked to reflect their learning experiences which they could collect individually and in teams by using the electronic diary functionality offered via the course's learning platform. In the context of this study, we analysed ePortfolios of 31 students by qualitative content analysis in order to find out whether the use of e-portfolios could enhance students' reflection on the input of the lectures

and deepen students' learning experience. Furthermore, students' assessment of the e-portfolios and their way of dealing with the e-portfolios were analysed.

The paper is structured as follows. In the next section a brief insight into ePortfolio theory is given. Section three describes the context of our study, in particular the course on HCI and Psychology is illustrated. Section four includes the empirical study. The final part of the article gives a conclusion.

2 ePortfolios

Carmean and Christie [8, p. 34] define effective ePortfolios as "a purposeful collection of student work that exhibits a learner's efforts, progress, and achievements in one or more areas." This ePortfolio definition is derived from Barrett [9], and comprehends an understanding of ePortfolio as a means of communicating growth made by the learner, ePortfolios are often used as a tool for assessment of learner performance, documentation of learner progress, and representation of outstanding learner achievements and records. Nevertheless, they can play a variety of other roles in educational environments (e.g. ePortfolios can be used for artefact creation and sharing, for setting personal learning goals, for practice using different types of technology to successfully solve required tasks, and for communication in order to provide feedback, for example from the teacher, peers, or outside experts, etc.). A very effective strategy in education is using ePortfolios for reflection [10]. In this use case, the ePortfolio facilitates learners' reflection on their learning process. The web-based services guiding and supporting learners in their learning processes manifest humancomputer interaction in several ways: First, students interact with the services in being loosely accompanied by them in their reflection. Second, educators have easy access to students' elaborations and documents and, reciprocally, can send comments to students. Third, peers can mutually read each other's reflections and thus gain additional perspectives and inspirations. In brief, the computer significantly increases the interaction among all parties and thus facilitates social knowledge construction. On a course level, ePortfolios (or reflective diaries) facilitate students to document and observe own learning development and to control the fulfilment of their learning goals. Students can be supported in writing their diary by providing various questions that inspire reflection [11].

3 Description of the Course Human-Computer-Interaction and Psychology

The course on human-computer-interaction and psychology was held at the University of Vienna as part of the Computer Sciences bachelor curriculum [12]. The course is placed in the fourth semester of the curriculum and its first iteration took place in summer term 2008, which is, as well, the time period of our study. As the course is one of the required courses of the Computer Science core curriculum, 116 students participated.

The course was organized as a lecture with regular face-to-face units and two modes of assessment. Students could choose among the conventional written examination at the end of the lecture and the so-called "interactive mode" supported by a tutor. The goal of the interactive mode of the lecture was to offer students the possibility to learn and deepen own interests and knowledge in the area HCI and Psychology in an active and self-directed way during a lecture where usually regular frontal teaching takes place. It was an additional mode, which ran parallel and in a linked way to the weekly lectures. The motivation to offer the interactive mode in the lecture was to facilitate individual learning with

- · learning experiences and self-initiated processes,
- use of HCI for practical tasks,
- · reflection of subject-specific and personal learning,
- more social interaction,
- connection of education and research for new expertise (optionally), and
- less exam stress.

The 31 students, who participated the interactive mode of the course, had to elaborate a team-project and write entries into an accompanying ePortfolio, which we called "diary".

First of all, students had to sign up for the interactive mode at the very beginning of the lecture. Then, students were asked to build small teams (2-3 members per team) and elaborate project proposals. These project proposals were reviewed by the tutor. Project goals, output and working plan were discussed in a personal meeting with the team. If the project proposals met the requirements, expectations, desired learning goals and outcomes of both, the educator and the team, then they acted as online learning contracts between the educator and the students [13] [14]. Using learning contracts helped us to facilitate freedom and self-initiated learning in the lecture. Students could define and follow their own learning plans and targets with a substantial degree of responsibility for their own learning [15]. They could explore and elaborate topics of interest in an active, self-directed way and thus deepen their knowledge in a special application of the course's subject matter. These activities were accompanied by the educator by giving feedback to students in online and faceto-face meetings to approve the self chosen themes. After reviewing and approving the project proposals, the teams elaborated contributions and deliverables (e.g. a project specification, project documentations and project output deliverables like videos, learning objects, slides). During this work phase, three work-in-progress inspections were done, in which particular submissions of the teams were reviewed and evaluated. In the last unit of the course, students presented their team-projects. This allowed all students to gain some insight into the interesting topics and results elaborated by the participants of the interactive mode of the course. In addition, presenters learned through experience how to mediate HCI aspects in a brief slide presentation.

Simultaneously, participants of the interactive mode reflected their individual and team learning in an ePortfolio (electronic diary). The diary was technically realized as a Blog which was offered as extended functionality on the learning platform CEWebS

(Cooperative Environment Web Services) [16] CEWebS provides a web-service-based architecture for cooperative environments. Web services are the central component of CEWebS in order to put blended learning scenarios into practice. (To read more about the CEWEbS architecture see [17, 18] [19]). Students could submit their diary entries with read permission for either all participants of the course, for only the facilitator, or for nobody in order to write diary entries for their personal use. Writing the diary was organized in four phases (derived from the "Writing-Survey-Writing Cycle" [20] [21]) during the course:

- Phase 1: Personal state of knowledge and expectations. Phase one started right at the beginning of the course and students were asked to write about what they thought they already know about HCI and Psychology, what experiences they made in this area and what their attitudes are concerning HCI and Psychology. Furthermore, we asked students to formulate their expectations on the HCI and Psychology course.
- Phase 2: Continuous reflection. Phase two immediately followed phase one and included questions concerning experiences and impressions of our students in the HCI and Psychology course, team work and team learning experiences, activities and experiences in the area of HCI and Psychology that went beyond course requirements (e.g. observations in the internet, working environment; literature research; etc.)
- Phase 3: Experiences collected in the team-project and in HCI and Psychology lectures. The question pool of phase three concentrated on experiences collected in the team-project and in the HCI and Psychology module. Some exemplary questions were: What worked successfully in the project? What would you change in the project in order to optimize HCI and Psychology aspects? What did you take home with you from the module/course HCI and Psychology, and what not? For what can you use your collected experiences from the HCI and Psychology module/course?
- Phase 4: Final reflection. Phase four was the last phase of the diary. We used this phase to ask students about their impressions to the diary, experiences with writing such a diary, the offered tool function, the recommended amount of words per diary entry. Finally, we asked students to write some recommendations for students participating the course/module HCI and Psychology in the coming term.

We suggested students to write around 100 to maximal 300 words, and not to exceed a time period of one hour per entry per week.

Before the final written exam took place, the instructor and tutor evaluated students' achievements in the interactive mode. In the interactive mode, students could in the best case obtain the grade C (satisfactory). To improve their grade (to B-good, or $A-very\ good$), students had to pass the final written exam. The points obtained from the exam were added to the points collected throughout the interactive mode. The HCI and Psychology course scenario is illustrated in Fig. 1 and Fig. 2 shows Person-centered e-Learning patterns which we used.

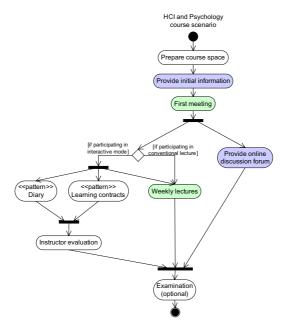


Fig. 1. Illustration of the HCI and Psychology course scenario as an activity diagram using coUML notation and Person-centered e-Learning patterns proposed by Derntl [22] [23]

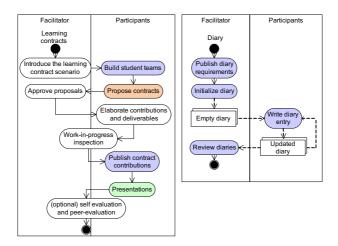


Fig. 2. Illustration of the Person-centered e-Learning patterns "learning contracts" [14] and "diary" in CoUML notation [23]. Colours of the activities represent different modes of presence: a green activity means that it takes place in face-to-face (or present) mode; a blue activity takes place on the web; a red activity illustrates that the activity takes place in a blended (mixture of face-to-face and web) mode; a white activity communicates that the mode of presence is not specified.

4 Empirical Study

Text and qualitative content analysis were applied to evaluate these reflections in the style of Mayring [24].

The primary goal of using a qualitative content analysis was to investigate students' reflection about their learning development and how the teaching method can support the understanding of HCI. Therefore, the following research questions were investigated in the qualitative content analysis:

- How did students experience the interactive mode (e.g. positive and negative feedback)?
- Could they recognize connections between the learning input of HCI and their life?
- Did the use of ePortfolios enhance students' reflection on the theoretical input of the HCI lectures?
- How did students assess the use of ePortfolios?
- What did students share in the ePortfolios?

4.1 Sample

The interactive mode was proposed for the first time in the bachelor studies of Computer Science. From 116 students who took the course 31 (~ 27%) participated in the interactive mode, divided into 13 teams (1-3 students per team). About 64% of the participants were male (20) and 36% female (11). About 74% of the participants successfully finished the interactive mode and the dropout rate was 26%. Students who dropped out the interactive mode claimed about too little time to meet all requirements and too much workload of the mode. All of the 31 participants of the interactive mode wrote online "diaries". Consequently, 31 online diaries with a total word count of 48763 could be analyzed. Students' online diaries were to be provided on the course's e-learning platform.

4.2 Results

First we analysed the situation in which the text is originated and its characterisations. In order to provide inter-subjectivity, categorisation was undertaken by two researchers. Finally, we verified, merged and interpreted the essential categorisations. Table 1 shows the final categorisations.

In the ePortfolios - or "online diaries", as most students named them, students wrote about a variety of topics, often closely related to the guiding questions for the reflections. They wrote about the interactive mode, their team project, the teamwork, the lectures, the lab courses and about connections between the theoretical input of the lectures and experiences in their everyday life. Often students wrote about the lectures (19 statements), they narrated the theoretical inputs (23 statements), reflected on them and gave feedback on lectures (18 statements) and specific lecturers (6 statements). In general, for most topics, statements addressing these three different levels could be found:

- Narration: students memorized what they could remember e.g. from a guest lecture; example for narration of the lecture: "Today we discussed the short term memory (how to adjust to the context of the user) and the long term memory."
- Reflection: students made connections between things they had learnt in the lectures and things that they encountered in everyday life or their previous knowledge; additionally they critically questioned input of the lectures); example of reflection on the lecture: "Another interesting point brought up in the lecture was the use of metaphors; thereby consistent symbols are used for the representation of functionalities. Some symbols result from the beginning of visual computing history, as for example the symbol of floppy disks, which still is used almost in all programs as a symbol for saving, although floppy disks are if used at all used very seldom. A change of the symbol probably cannot be recommended right now, since most users are familiar with this metaphor and a change would lead to problems. Nevertheless, I am curious, how long it will take, until the saving-symbol will be changed or whether we will still use the same symbol in 50 years."
- Feedback: students assessed instructional methods used in the course or they proposed possibilities for improving the interactive mode; example of feedback regarding the lecture: "The last lecture was again, very interesting; it was nice to see how our eyes can fool us and that perception is not as perfect and reliable. According to my opinion it was nice to see, that the lecture is always presented with pictures and videos, what deserves praise, because it contributes to a better understanding of the subject matter."

Category Subcategory Statements Impression of the Lecture General 19 23 Narration Reflection & Feedback 24 General positive attitude to HCI Positive 44 8 Feedback about the interactive mode Time-consuming Effective learning 12 Grading 6 HCI in everyday life 24 Lab course 17 Language 6 Diary Personalization 43 21 Feedback about the idea 11 Feedback about the tool Experience with writing the diaries 11 Number of words 12

Table 1. The merged category system of the qualitative content analysis

We found out that the students wrote a lot about their **positivities according to HCI** (44 statements). They noted that HCI is a very important aspect in Computer Science and an essential factor for the success of a product. Examples were "Computer Science should not only be engaged with functional aspects of products. It is

also necessary to know how humans interact with these products.", "I think it is also important to learn how to analyse Usability, because we want to develop homepages or applications, which are more user-friendly. This topic will be also important for our future jobs", and "The gain in experience from the HCI lecture, exercise and project will be reflected in future projects (homepages as well as software) according to an optimal adjustment to user groups".

Furthermore, students gave us **feedback about the interactive mode** (26 statements). Three different kinds of statements could be found:

- **Effective Learning:** students found that the interactive mode gave them the possibility to learn HCI more effectively (12 statements); example for effective learning of the interactive mode: "It was a very interesting module, because we learned a lot about interaction. It was never boring and stimulated our creativity."
- **Time-Consuming:** students noted that interactive mode is more work than a "traditional" lecture with a final examination (8 statements); example for time-consuming of the interactive mode: "Perhaps it is not a bad idea, but it is very time-consuming, particularly the diaries, because of the regularly required entries."
- **Grading:** students wrote that the grading of the interactive mode was not clear or fair enough (6 statements); example for grading of the interactive mode: "The specifications and the assessment criteria were not clear enough. Additionally, I think it is better to get more points, because it should be an alternative to the lecture. But if you want a better grade you need the exam in addition, because with the points of the interactive mode alone you can only get an average grade."

Additionally the diaries showed that the interactive mode made students more aware of **HCI** in everyday life (24 statements). For example 2 students could see conclusions between an exhibition and HCI: "I visited the exhibition 'Dinner in the Dark'. [...] Since this visit, I think about accessibility of websites, computers and operation systems for blind people and I'm appalled that there is so little done for these people."

In addition, the **lab course** of the module HCI played a significant role in the diaries (17 statements). Students wrote that they could implement what the learned in the interactive mode as well as in the HCI lecture and in the HCI lab course. They liked the fact that the lab course was matched with the lecture (e.g. "For us it is easier to learn the theory from the lecture with the help of the practical exercises. Therefore, we get a good overview about good web designs.").

Another interesting aspect was the **personification** of the online diaries. In at least 8 student's diaries a personification of the diary could be found, although this was never explicitly asked by the instructor or the tutor of the interactive mode. Examples for personalization of the diary were for example: "Dear diary. I am sorry that I neglected you the last days, but I had much to do and I am really sorry ©", So, dear diary, that was it for a start, if anything else happens, you will be the first to know it, bye" or "What a wonderful day it is today! Please excuse that I didn't write into you for a long time. No, there isn't anybody else. No, you are the only one for me. Let me tell you what happened in the meantime while we haven't seen each other."

Another aspect mentioned by students was the **language**. The course language was German and 6 students noted that the language was an additional challenge for them (e.g. "I'm worried about the foreign language.")

In the last part of the diary, students were asked how they found the idea of the online diaries (21 statements), whether they felt well supported by the tool (11 statements), how they experienced writing the diaries (11 statements) and fulfilling the proposed word count (12 statements).

Interestingly four statements described students' scepticism towards writing the diaries in the beginning, but then the students' appraisal got better and they valued the diaries (e.g. "I liked the learning diary, although I have to admit that it was a burden in the beginning, because I didn't know what to do with it and especially, what to write into it."). Despite of one student who found writing the diary annoying, all other statements by students were positive. Online diaries were experienced especially valuable for memorizing inputs of the lectures (4 nominations, e.g. "Very good [idea], because I could do a repetition of the lecture and because I additionally wrote it down, I could memorize much more, than I would have thought." Two students valued the feedback aspect of the diaries (e.g. "I found it good, because it is important for the lecturers. Due to our [written] opinions, the lecturers could get a feedback and now can optimize the courses and transfer the course mode to other courses as well." and further two appraised the possibility to document the project of the interactive mode (e.g. "The learning diary was a good possibility for us to track our project. For me it was an opportunity to plan the project in the right way from the beginning on.")

4.3 Implications for Human Learning

Many students described the interactive mode of the course on human-computerinteraction and psychology as a possibility to learn HCI effectively. Learning effectively in this case means, for example, to learn continuously by regularly reflecting themes heard in the lecture and working on self-initiated HCI projects. We observed that students were enthusiastic and highly motivated to work on their project as they could elaborate their own project-themes and organize their project-work according to their own ideas. During the project work students could pursue their interests in HCI and develop their creativity. Entries of the diaries showed, that students reflected on various aspects of HCI during the whole summer term, which were discussed in the lecture as well as observations beyond course borders by students. Thus, students learned actively and without or just with a low level of stress during the whole semester term, in contrast to cumulatively learning several days before the final exams. As the diary provides space for students to reflect on lectures, reflected topics could be memorized easier. One student argued: "The idea of the diary was great, because I could repeat what I heard in the lecture and as I wrote the reflection in the diary, it was easy for me to remember things." Another positive implication of the diary was that students could use it as a kind of learning protocol and document what they have done and learned during the semester. This learning progress documentation gives students transparency concerning their learning status. For example, one student wrote: "Furthermore the diary gave insight into what things were done or learned and who made what in the team project."

Students' performance of the interactive mode was high and manifested itself in creative projects. For example, one student project was the elaboration of a cyber cell phone 3D-model focusing on design and user interface aspects. Another example was the elaboration of a video illustrating the functionality of face-tracking in cars, elaboration of possibilities of internet accessibility for blind and visually handicapped persons, etc.). Also, detailed diaries (most of the students wrote among 8 and 15 diary entries) confirmed students' interest in active learning.

4.4 Suggestions for Improvements

The results of the qualitative content analysis offer the possibility to recognize improvements for the future:

- Language: For students, whose mother tongue is not German, it would be helpful to make it explicit that projects and entities of diaries can also be written in English.
- General process of the interactive mode: Based on the fact that the interactive mode was proposed for the first time, it was not exactly clear how time-consuming the projects are. It would make sense to think about the point-system in connection with expenditure of time (e.g. to give bonus points for extensive projects). All requirements regarding main aspects of the interactive mode need to be presented more transparently in the beginning of the course.
- Exam: It seems reasonable to decouple the interactive mode from the traditional exam.

Issues noted positively and hence to be kept were:

- **Project:** Students could realize their own project idea and could choose their group members by themselves.
- Lab Course: Students could put the learned input of the HCI lecture in the interactive mode as well as in the HCI lab course into practice. This provided a deeper understanding of the field.
- **Lecture:** Students found the integration of additional practical examples (e.g. showing videos or comparing homepages) in the lectures units as positive.

5 Conclusions and Further Work

Our experience in the interactive mode of the "lecture" in HCI and Psychology confirmed our initial hypothesis regarding the enhancement of learning due to increased reflection and various forms of interaction. Although the new and innovative interactive mode was met with scepticism in some students initially, and a few students dropped out in the very beginning, all students who completed it perceived it as constructive and effective. Retrospectively, the manageable increased effort on the side of instructors contributed to meeting learning goals on the level of professional as well as generic competencies, in particular communication, giving and receiving feedback, team competence, presentation skills and self-directed learning.

The course example described in this paper showed that usable and simple webservice technology has the potential to promote sustainable, deep and social learning. This is particularly the case if it is applied by educators who give feedback and act as facilitators rather than acting as pure experts and examiners. Thus, diary and interactive team-space web-services proved invaluable in facilitating improved interaction and, in general, raised awareness of the importance of computer-mediated interaction in learning. Web services play the role of enabling technology with simple, usable user interface.

Further work will redesign the course on HCI and Psychology along the "lessons learned" from our initial experience. The interactive mode will be refined and complemented, and offered as a self-contained alternative to the traditional exam. The course will be tracked by empirical studies in order to provide still more insight into the dynamics of learning. In particular, we are interested in students' unfolding in the area of generic competences which appear to be hard to measure objectively.

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