

“Creation of Virtual Social Networks in Distanced, Informal Learning Settings through collaborative Story-Writing - Implementation and Testing of a New Metaphor Prototype”



MSc Computing Project
[Terms of Reference]

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MSc Informatics: Project Terms of Reference

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Title: “Creation of Virtual Social Networks in Distanced, Informal Learning Settings through collaborative Story Writing - Implementation and Testing of a New Metaphor Prototype”

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01. Proposed Supervisor: Prof. Paul Brna

02. Background Information

The master dissertation builds on my former bachelor dissertation „concept and user interface design for a cscl-environment for intercultural communication“ at technical university dresden, germany. (within this ba-work I developpe the focus-metaphor which shall be applied within the msc-work)

Furthermore, the literature review from last semester „The dimensions of interfaces for computer-supported collaborative learning environments“ shall build an fundamental introduction into the topic and shall be included in an appropriate form.

03. Project Outline

3.1 Introduction

3.1.1 Motivation for Dissertation

The dissemination of the internet strongly facilitated the movement towards the **information age**. After the networking of servers and slowly every computing device, the internet begins to network the people behind these interfacing devices. It starts to create virtual communities (*Rheingold, 1993*), **knowledge networks** (*Hildreth & Kimble, 2004*) and hopefully **social networks** (...). This is a long way to go, but the demand for knowledge as the essential global resource implies the idea of collaboration to share knowledge.

Based on novel educational research, constructivism (*Bruner, 1966*) is the most promising learning theory, which led to methods like "experiential learning" (*Kolb, 1984*) and "discovery learning" (*Bruner*).

The use of stories in learning context (*Salmon, 1985*), also referred to as "**story-based learning**" (*Laqua, 2003*) seizes constructivist methodologies and combines them with human interaction.

This work bases on an earlier work "concept and user interface design for a cscl-environment for intercultural communication" (*Laqua, 2003*), conducted as bachelor dissertation at Technology University of Dresden in Germany. The user interface design in this work led to the conception of a new metaphor, the focusmetaphor (*Laqua, 2003*).

3.1.2 Structure of Dissertation

As a starting point, **chapter two** of this dissertation reviews existing interface solutions for collaborative environment and establish a reasoned basis for the development of a prototype using this focusmetaphor. **Chapter three** then describes the focusmetaphor approach and point out its advantages. The following **chapter four** reviews the influence of stories for collaboration in the learning context and explain the cognition psychological connections with the focusmetaphor approach.

After this, **chapter five** reviews possible technologies, which cope with the actual and future demands of the users and reason the technology decision.

Chapter six provides a description of the developed prototype and includes a reflection of the development process.

Before testing the prototype, the focussed user group needs to be defined and adequate test users have to be found, which will be reflected by **chapter seven**. Subsequently **chapter eight** reviews possibilities of usability testing and evaluates them to form a decision for the most appropriate qualitative and quantitative testing methods.

Thereafter **chapter nine** describes and analyses the conduction of testing and includes the evaluation of the results. In chapter ten, a comparison with other user interface design ap-

proaches follows to establish a relationship with the results of this work.

Finally, **chapter eleven** draws conclusions of the conducted research and prototype development, reflecting the achieved results and **chapter twelve** adumbrates visions connected to this dissertation.

3.2 Interface Research for Dissertation

3.2.1 Boundaries of Investigation

To facilitate communication actions using human computer interfaces, it is important to examine the learner characteristics and needs. Within the field of CSCL-Environments the observation has to take place in often cross-cultural surroundings, what may lead to communication problems and misunderstandings (*McKee, 2002*) and technologically advanced situations. For this reasons it is important to develop user friendly and intuitive interfaces (*Nielson, 2000*).

Therefore metaphors are known as a suitable solution to develop a deeper understanding of these abstract and complex settings.

While graphical user interfaces (GUI) are a well known area of research and a good subject to apply metaphors to, this just builds up the concrete interaction of a learner with a specific piece of technology through a display.

With a view on the complex learning situations within the field of CSCL there are much broader possibilities of applying metaphors (to much more complex interfaces). Complex learning situations like described by *Price (2003)* ‚using „tangibles“ to promote novel forms of playful learning‘ and by *Luckin (2003)* ‚using digital toys‘ give an idea of the enormous range of project settings. In these examples technology in form of handhelds, displays, electronic toys or other multi-modal devices become part of the learning situation. They are components of the overall interface between the learner and the learning environment and for this reason just elements of the underlying metaphors.

An investigation of interfaces for CSCL therefore needs to deal with graphical design issues as well as with the underlying learning concepts, the targeted user groups and the social context - there must be significant differences for in-class collaboration and distributed collaboration.

While research on CSCL and the development of appropriate environments is just in the beginning, the overall usefulness of this learning method/concept and the wide range of applicability is/should be obvious. As a result research on a variety of projects on CSCL is undertaken all over the world at the moment. To structure these projects (and the researched literature), a 2-dimensional classification will be introduced.

3.2.2 Interface-Dimensions of CACL

3.2.2.1 The Technical Dimension

The use of technology is quite varying among the different projects and therefore the complexity of the according interfaces.

Simple Interfaces

For this category exist quite a view usable software packages, like FirstClass which has been analysed by *Persico (2000)* and is ‚used by the British Open University‘. Another possibility is the development of an own solution like TimeScope3, an interactive storytelling system for heritage presentation, which is used for fostering collaboration among visitors and is described by *Pletinckx (2003)*.

Complex Interfaces

With an extensive use of technology *Price (2003)* argues that ‚using „tangibles“ to promote novel forms of playful learning‘ will bring ‚the passion and pleasure back into learning‘. Further more *Luckin (2003)* indicates the positive aspects of digital toys for increased social interactions.

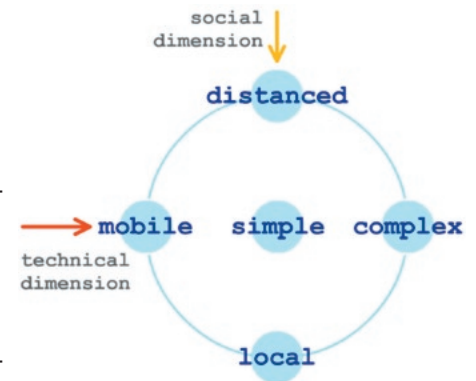
Mobile Interfaces

The growing importance of wireless-LAN, the spreading of notebooks, powerful mobile devices like smartphones or PDAs and UMTS technology imply the reasons for CACL-research in this area. One example is reported by *Gay (2001)* who reflects a university-based research on ‚the effects of wireless computing in collaborative learning environments.‘

3.2.2.2 The Social Dimension

For a deeper investigation of the different interfaces it is additionally necessary to look at social issues of the specific projects because the development of social networks is essential for successful collaborative environments.

For this reason, **classroom settings** like researched by *Pimentel (2001)* and *Hoppe (2000)* work under different conditions than **distance learner environments** like investigated by *Cronjé (2001)* and *Persico (2000)*. *Corritore (2003)* indicates that building up trust is ‚a key element of success in the on-line environment‘. While complex environments and their interfaces are mostly experimental and strongly specialized without many possibilities of generalization, they are of minor interest for researching functional, innovative and reusable interfaces for collaborative learning. Therefore this review concentrates on design issues for simple and mobile interfaces.



3.3 The Focusmetaphor Approach

The Focusmetaphor has been evolved from a collaboration with Prof. *Groh (2003)*, holder of the professorship for media design at the Technology University of Dresden during my Bachelor dissertation.

It combines aspects of design theory, cognition psychology and educational theory as well as general usability issues.

- advancement of desktopmetaphor and portal metaphor
- counteract the effects of "second visit blindness" on websites
- » develop a dynamic and adaptable interface which is personalisable

The focusmetaphor picks/takes up the principle of cortical connectivity and its importance for cognitive functions (*Fuster, 1998*) and tries to apply them to the design of user interfaces.

"... learning and the acquisition of memory are based on the synaptic linkage of elementary cortical representations" (Fuster, 1998).

"The focusmetaphor aims to support learning processes through basing its visual representation on these cognition psychological principles" (Laqua, 2003).

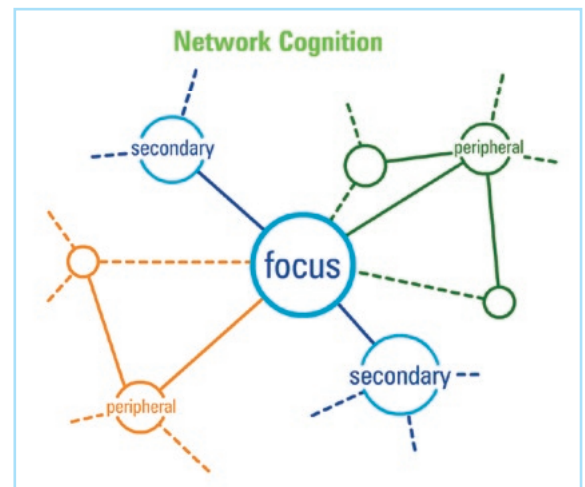


figure 3.1: network cognition

A hierarchical structure is used to manage the visualized elements. The number of these elements should be around five to seven, according to the capacity of short-term memory (*Miller, 1956*): "...instructional design for the learning purpose should keep the limits of short-term memory in mind" (*Pastor & Hoffman, 2004*). The "element of most interest" for the user is presented in central focus in the middle of the screen. Other elements of interest for the user which are in context to the focussed element are dynamically grouped and arranged around this primary focus element. Depending on their importance they are represented in secondary or peripheral focus.

Figure 3.2 provides a visualisation of the metaphor and on www.go2pinc.net a flash-dummy simulates the basical representation.

Some existing novel user interfaces for information portals, such as myMSN and myNetscape, use a grid- or table-layout approach to allow users to arrange, show and hide information moduls. But these interfaces are static, plain 2-dimensional and without contextual intelligence.

The wide difference of the focusmetaphor approach is the usage of hierarchical information and its hierarchical representation.

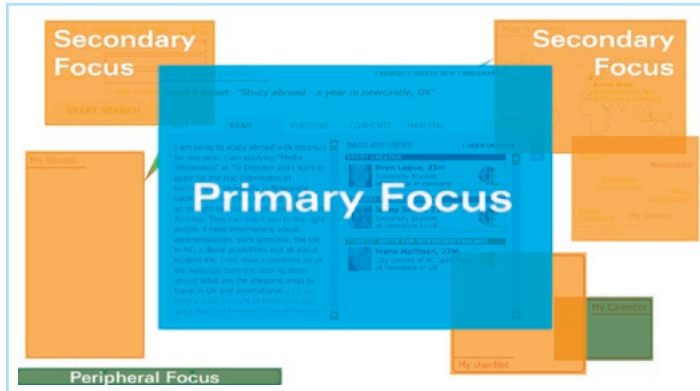


figure 3.2: metaphor visualisation



figure 3.3: interface visualisation

XML shall be used to manage “information importance level” (Laqua, 2003) and their allocation to the according presentation level.

Depended on the level of presentation, the amount of presented information is varying.

Only this combination - hierarchical organisation of information, dynamically in real-time, as basis for a visual hierarchy - can reasonably enable the focusmetaphor approach. This hierarchical order shall help learners to concentrate on one specific and important context and support learning processes.

Information which is not necessary disappears or represented according to its importance (secondary or peripheral focus). The Xerox Palo Alto Research Center has a very similar emphasis with the research of Degree of Interest (DOI) Trees.

Card et al. (2003) describe in several articles their approach and the related company Inxight offers products like Star Tree to represent and browse through large hierarchies of information. Another similar solution is presented by TheBrain, which offers PersonalBrain, WebBrain and BrainEPK (Enterprise

Knowledge Platform). Both companies use Java as language of choice. A detailed discussion of usable technologies is placed in chapter five and reflects on J2EE, Java applets, jsp and novel flash innovations like the Flex presentation server which uses java and MXML, an XML based markup language.

But the problem which still remains in their approach is the separation of navigation and information representation.

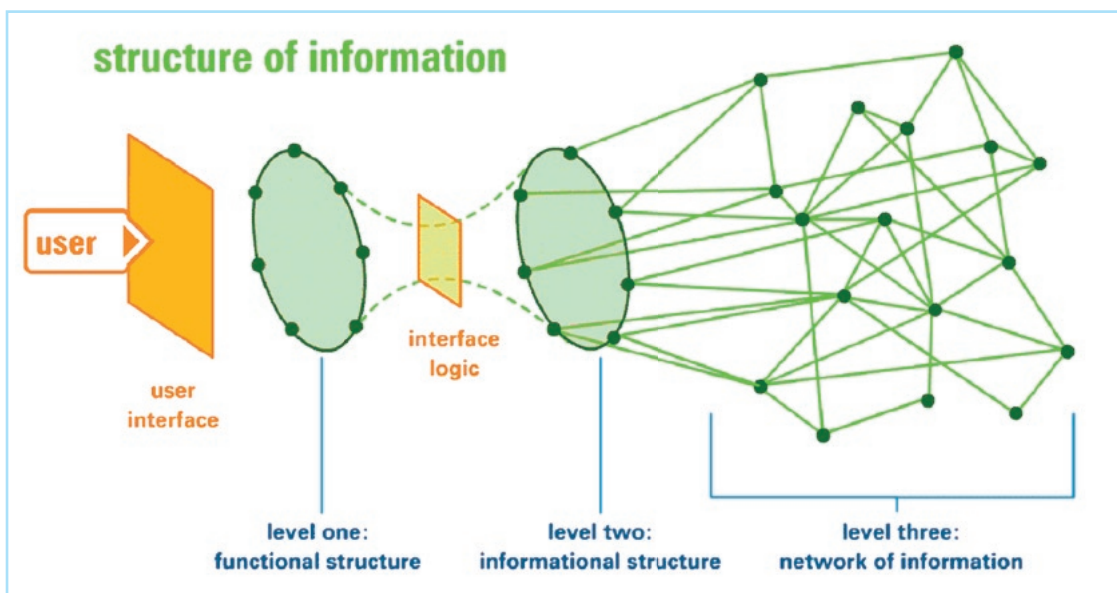
These breakings of abrupt switches between navigation and information especially disrupt cognitive processes.

The focusmetaphor approach aims to overcome this issue, which is important to support user orientation and facilitate learning processes. As the interface visualisation in figure 3.3 shows, the presented elements are specific moduls of information, which together build the learning environment. Smooth and continuous motions shall be used to switch focus and rearrange elements.

How it works

If the user switches his/her focus from the element of primary focus onto an element of secondary or peripheral focus, which could be realized through mouse-over or in future developments may be also with eye-tracking, this element comes to the front to provide its information completely. An overlapping with the element of primary focus might have caused restricted view onto this element. If the user decides to stay with his focus on this new element, which could be realized with mouse-click, it takes over the primary focus, presenting its complete information and forces the other elements to rearrange according to the context with the new primary focus element. Some presented elements might therefore disappear and others show up. This gives the user a feeling of involvement and of active interaction where he seems to be a navigator in a networked world of knowledge knots.

“Memory networks are probably hierarchically organized, overlapping anatomically, and profusely interconnected. Accordingly, any neuron or group of neurons, anywhere in the cortex, can be part of many networks and thus many memories” (*Fuster, 1998*).



04. Research Areas

- computer supported collaborative learning
- story-telling
- human computer interfaces
- usability testing

05. Project Aims

The main aim of the project is to examine the usability of a novel metaphor interface within a CSCL context through the design, implementation and evaluation of a prototype system.

06. Problem Statement / Hypothesis

1. Actual GUI's for CSCL-Environments are unsatisfying for users ?!
 - » Metaphors used are not state of the art ?!
 - » A metaphor is needed that helps the user to focus on learning context, but still provides him with all necessary tools to support learning...
2. How to motivate people (future user) to get together for collaboration ?
 - » Priority task for creation of social networks!

07. Project Objectives

- A review of learning interfaces, their metaphors and the measured success
 - » use the existing literature review (Laqua, 2003b) as the starting point
- Justification for technology chosen (java, flash, dhtml)
 - » probably java (review existing api's, frameworks, tools that support the development)
- An implementation plan (UML-diagrams, definition of functions, ...)
- Implementation of a prototype of the new metaphor prototype (with limited functionality)
- A review of stories as an engine to foster collaboration among peers
 - » use story-writing as context for user collaboration
 - » guided writing of personal stories with test users
- A review of testing and evaluation strategies
 - » qualitative (formative, eye-tracking, mouse-tracking, experts, ...)
 - » quantitative (questionnaires, ...)
- A justification of the selection of appropriate methods
- Report on usability test
- Analysis of usability results
- Comparison of results to other projects (Microsoft Research ?!)
- Dissertation report

08. Outline Dissertation

1. Introduction
2. dimensions of interfaces for collab. environments
3. the focusmetaphor approach
4. the influence of stories on collaboration
5. the power of java - how to build an modular and adaptive interface
6. description of the prototype
7. discussion of user group and finding test users
- 8.1 review of usability testing and evaluation
- 8.2 *the importance of formative questionnaires ?!*
9. conducting the testing and evaluation of results
10. comparison with other approaches
11. conclusions
12. Visions - the importance of collaboration for CRM (C-Commerce)

It is possible that some sections will be merged or slightly differ in their focus.

09. Relationship To The Course

- CG093 Applications Design in Java
- CG165 Advanced Applications Development in Java
- CG169 E-business System Development and Deployment

10. Project Planning

10.1. Schedule of Activities

- a) **Research**
 - Learning Interfaces
 - Stories in Learning context
 - Technology choices
 - Testing and Evaluation strategies

- b) **Prototype Development** (iterative design process)
 - Implementation Plan
 - Questionnaires

- c) **Prototype Evaluation**
 - User Testing, Experts, ...
 - Analysis of results

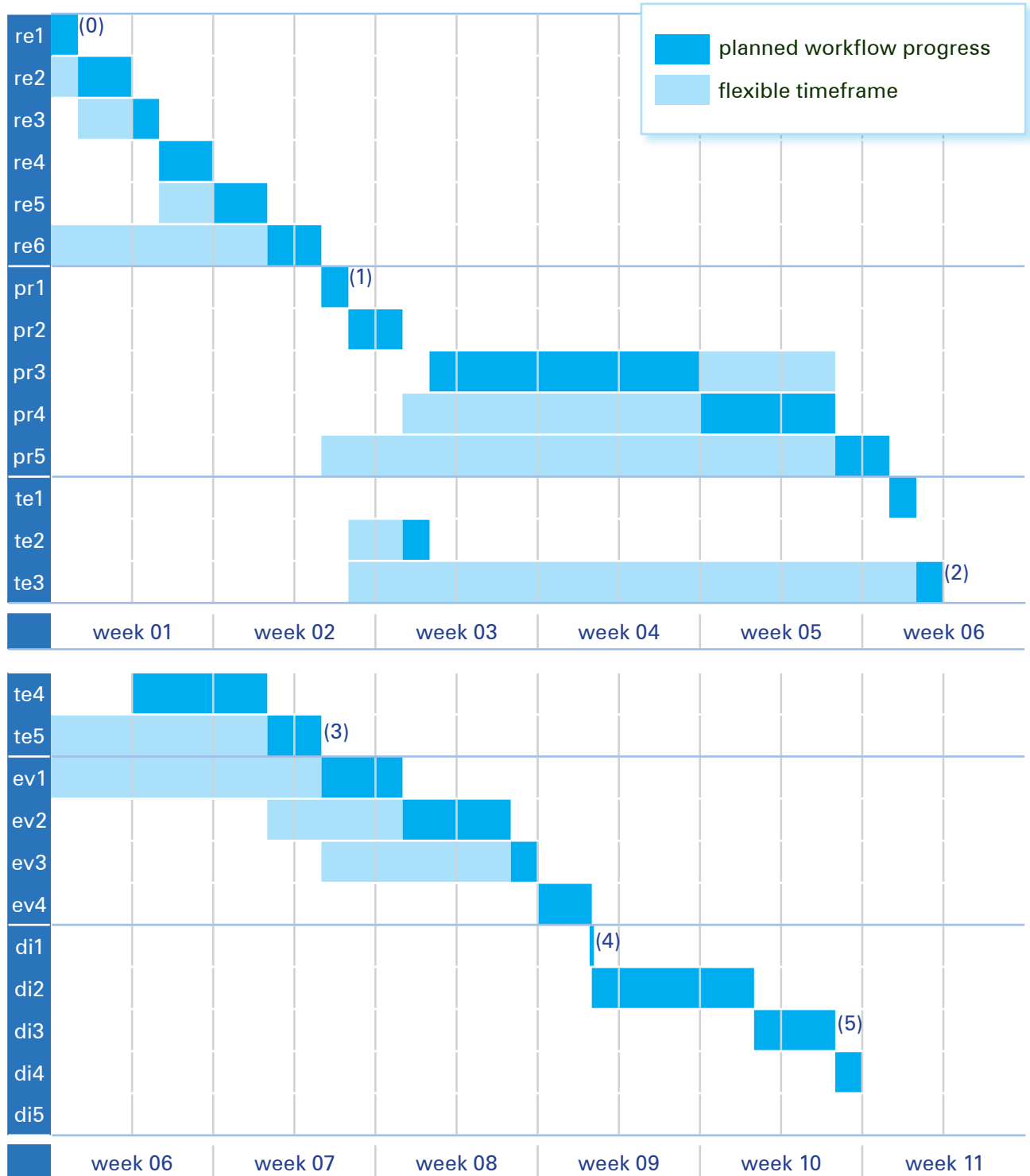
10.2. Milestones

- i) **Completion of research (100h)**
- ii) **Completion of prototype development (200h)**
- iii) **Completion of user testing (100h)**
- iv) **Completion of evaluation (100h)**
- v) **Completion of dissertation (100h)**

10.3. Work Breakdown Structure

MSc Computing Project					
Manage Project	Research	Prototype Development	User Testing	Evaluation	Dissertation
ma1	re1	pr1	te1	ev1	di1
Risk Analysis & Management	review learning interfaces	justification on technology	decide on qualitative methods	analyse questionnaires	layouting
ma2	re2	pr2	te2	ev2	di2
Manage Project	review stories in learning context	implementa- tion plan	decide on quantitative methods	analyse user testing	writing
	re3	pr3	te3	ev3	di3
	review possible technologies	iterative prototype im- plementation	find test users	analyse discussion with experts	conclusions and vision
	re4	pr4	te4	ev4	di4
	testing strategies	iterative questionnaires	conduct test- ing (eye-tracking?!)	comparison with other approaches	check-reading
	re5	pr5	te5		di5
	evaluation strategies	processing development	involve experts		hand-in (10 sept 04)
	re6				
	processing aims				
10 weeks each 60h = 720h	100 hours = 10 days	200 hours = 20 days	100 hours = 10 days	100 hours = 10 days	100 hours = 10 days
15,000 words altogether =	6000 words research	2000 words description of development and prototype		5000 words description of testing and analysis of results	2000 words conclusion and vision

10.4. Gantt Chart



- (0) - This part will base mainly on a former literature review, written in CG162 (Laqua, 2003c).
- (1) - J2EE as a key technology can be analysed earlier during the assignment of the according CG165.
- (2) - Search for possible test users starts earlier but final decisions have to wait until end of te1+te2.
- (3) - This will depend on availability of appropriate experts and their time-slots.
- (4) - Development of an appropriate layout has been conducted within this TOR.
- (5) - This is aimed to include or refer to an research essay, written in CG 169 on C-Commerce and CRM.

10.5. Risk Analysis

The Work Breakdown Structure (WBS, chapter 10.3) and the Gantt Chart (GH, chapter 10.4) try to give a first impression of the project and its planning. The WBS refers to the milestones in chapter 10.2 and lists the main tasks for each milestone. It furthermore includes a brief description of the time requirements and the aimed wordcount for each section.

Time Planning

The schedule that is visible in the GH bases on a six days per week and 10 hours per day working plan. This would result in an overall scope of 10 weeks for the 600 hours project. The period in summer available for conducting this project should allow a scope of about 13 weeks. Furthermore allows the assignment of 6 working days for each week an additional 7th working day in case of emergency or time pressure. As a conclusion the actual time planning of 600 hours includes a time buffer of around 100 to 200 hours which is 15 to 30 percent of the actual planned time.

Project Risks

The project includes a variety of different risks. With this analysis it is tried to discover them, measure impact and likelihood and develop a project plan that is able to deal with these risks and ensures the realization of the project.

Top Ten Risk Items (Boehm, 1998):

1) personnel shortfalls

Involved personnel consists of the student (Sven Laqua), the supervisor (Prof. Paul Brna) and test users. The *test users* are a critical item within the personnel. To ensure a high quality for the prototype testing, the selection of appropriate test users is an important process. To guarantee availability of the necessary amount of test users, the acquisition process has already started, will last until the deadline (te3) and aims to build up a stock of about the double of needed test users.

Impact: 6

Likelihood: 3

2) unrealistic schedules and budgets

The first version of the *project schedule* is represented by the Gantt Chart in chapter 10.4. The time planning might be tight and without gapes but it already includes a buffer of 15 to 30 percent, as mentioned in the above "Time Planning" paragraph, to deal with possible problems.

Impact: 4

Likelihood: 7

3) developing the wrong software functions

The development of the *prototype interface* is already limited to a bundle of essential functions to conduct the testing and evaluation and to assess the quality of the new metaphor within the learning context. Therefore it is quite unlikely that the wrong functions will be developed.

Impact: 7

Likelihood: 2

4) developing the wrong user interface

The prototype aims to *test a new metaphor approach* for the learning context. The evaluation might lead to a failure of this approach for some reasons. But this is no risk of the project itself, because a failure of the interface is a possible result of the project. Furthermore the interface is the object of research for this project and the development of the wrong interface is fairly unlikely. Developing the right interface but without all aimed functionality is another possibility, but again a possible result, which would be reflected in the evaluation and the conclusion of the dissertation.

Impact: 6

Likelyhood: 2

5) gold plating

The awareness of a broad project and a good project planning should pretend from gold plating.

Impact: 4

Likelyhood: 3

6) continual stream of requirement changes

The awareness of a broad project, a good project planning and the involvement of the supervisor should also pretend from streams of requirement changes.

Impact: 5

Likelyhood: 2

7) shortfalls in externally furnished components

The qualitative testing of the prototype might include *eye-tracking*. According to Prof. Pam Briggs and Philip Walker there should be no problems with using the equipment at Northumbria University. Philip Walker furthermore makes himself available for demonstration of usage. In case of problems with this testing method, further qualitative testing methods will have been analysed with the research part of the dissertation and the usage of mouse-tracking as an alternative shall be prepared.

Impact: 5

Likelyhood: 3

8) shortfalls in externally performed tasks

The quantitative testing will probably consist of *questionnaires for test users* who accompany the iterative prototype development. The success of the this method is dependent on these test users. As a result, it will be tried to keep their number high enough for guaranteeing enough feedback.

Impact: 5

Likelyhood: 4

9) real-time performance shortfalls

not relevant

10) straining computer-science capabilities

There should be no hardware related problems occurring during the project. Most of the project will be done on a private workstation if Raid 0+1 and additional back-up capabilities. A networked laptop is available in case of emergency and finally the PC laboratories at School of Informatics.

Impact: 8

Likelyhood: 1

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