

DISSERTATION

Constructing the Learning Environment in Classroom Convivial Computer Tools for Higher Education

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A Dissertation submitted in part fulfilment of the
Degree of Doktorin der Ingenieurwissenschaften (Dr.-Ing.)
Fachbereich 3 (Mathematik & Informatik), Universität Bremen

Bremen, 2011

We don't need no education

We don't need no thought control

No dark sarcasm in the classroom

Teachers leave them kids alone

Hey! Teacher! Leave them kids alone!

All in all it's just another brick in the wall.

All in all you're just another brick in the wall.

"Another Brick in the Wall" Lyrics, Pink Floyd, 1979

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ABSTRACT

New education technologies are coming on stream, enabling connectivity among teachers, facilitators and students. Students have to learn how to access Managed Learning Environments each time they move to different course websites. These barriers can hinder the real understanding of the subject matter for a course. This research calls for a rethink of pedagogical process towards blending together commonly used emerging social software and legacy educational tools rather than developing new tools for the classroom. Indeed, a learning tool should fit well to the learning model and philosophy of that course. Three case studies were conducted through different courses in the *Digital Media* master program and *Informatik* program at the University of Bremen, Germany. Students worked in small groups to design digital media and learning portal that should make learning more interesting and meaningful for them. At the end, this research proposes the concept of *Constructing the Learning Environment* in classroom and *Convivial Computer Tools* for higher education, where students and teachers, via dialogues in the class, can negotiate to deploy a set of selected tools and functions to match their learning needs. It is also to show that a tool with too many functions can cause confusion, rather than enhance effectiveness. To empower collaborative, interactive and personal learning, this work proposes the blended learning and classroom procedures for a convivial selection of educational tools. At the end, our innovative attempt is to bring constructionist learning into the higher education context.

ZUSAMMENFASSUNG

Der Einsatz und Gebrauch neuer Bildungstechnologien, die Zusammenarbeit und Kommunikation zwischen Lehrenden, Moderatoren und Studierenden ermöglicht, ist bereits Bestandteil der Unterrichtspraxis geworden. Hinderlich ist es jedoch, dass Studierende sich regelmäßig auf die technischen Gegebenheiten eines Lernsystems einstellen müssen, wenn sie die Web-Angebote verschiedener Kurse aufrufen. Diese Zusatzanforderung kann zur Barriere werden, die vom eigentlichen Thema des Kurses ablenkt. Mit dieser Forschungsarbeit wird die Gestaltung des pädagogischen Prozesses in Hinblick auf die Konzepte und Möglichkeiten der web-basierten Sozialen-Software für Integriertes Lernen (Blended Learning) fokussiert und nicht die Entwicklung neuer Tools. Darüber hinaus sollte das Konzept und das Nutzungskonzept eines Lernmediums zur Lernphilosophie, Lernmodell und Lernmethode eines Kurses passen. Es wurden drei Fallstudien in den Studiengängen Digitale Medien (International Master Program Digital Media, Bremen) und Informatik an der Universität Bremen, durchgeführt. In kleinen Gruppen entwickelten die Studierende prototypische Entwürfe eines Lernportals für Studierende des Studienganges Digitale Medien, das motiviert, und dabei unterstützt das eigene Lernen als bedeutsam zu erfahren. Zielsetzung der Forschungsarbeit ist es Konzepte zu erproben um ein Model die Gestaltung einer Lernplattform und eines Sets von kollaborativer Lerntechnologien (Tools) für die Hochschullehre zu entwickeln, die es den beteiligten Lehrenden und Lernenden erlaubt Tools auszuwählen, und sich die Lernumgebung den eigenen Bedürfnissen und Erfordernissen, durch Abstimmungsprozesse während des gemeinsamen Lernprozesses, anzupassen. Gesichtspunkt für die Auswahl der exemplarisch vorgeschlagenen Tools ist es, dass ein Tool mit zu vielen Funktionen eher zur Konfusion des Lernenden denn zum effektiven Einsatz führt. Wichtig war zudem in der Konzeption die Unterstützung kollaborativer Arbeitsformen, die das Spektrum der Interaktionsmöglichkeiten erhöhen und den Lernenden in seinem persönlichen Lernprozess unterstützen, zu berücksichtigen. Der intendierte Kontext ist Blended Learning und die gemeinsame Anpassung der Lerntools durch die Lerngruppe. Unser innovatives Anliegen ist es konstruktionistische Lernformen stärker in die Hochschullehre einzubeziehen.

ACKNOWLEDGMENTS

I would like to take this opportunity to express my immense gratitude to the many people who have given their time, energy, inspiration and prayers in support of my efforts on this dissertation.

First and foremost, I am profoundly indebted to my supervisor, Prof. Dr. Heidi Schelhowe, who was very generous with her time and knowledge in suggesting me the outlines of this work and supporting me to complete the dissertation. I would also like to extend thanks to my co-supervisor, Prof. Dr. Jürgen Friedrich, who gave me a precious advice every time.

It is an honour for me to work with Prof. Dr. Seymour Papert, who inspired me to begin thinking about learning with new technologies during the implementation of Project Lighthouse in Thailand. I would like to give memorial thanks to Prof. Dr. Ivan Illich for having dialogue with me about technology and *Deschooling* idea by his last colloquium lecture at the University of Bremen.

Next, I would like to express my deepest gratitude to Dr. Rawat Siripokarpirom, who discussed and corrected my doubts about computer engineering and software development. Thank you for his technological knowledge and guidance.

During the time of writing I received support and help from many people, I am grateful to Dr. Suthep Madarasmi and Dr. Hathai Tan-tangai for their careful proofreading of this thesis. In particular, I owe sincere and earnest thankfulness to Achara Deeboonmee Na Chumphae, who also read, reread, edited and provided invaluable proofreading help at various stages.

I thank my friends and colleagues at the Digitale Medien in der Bildung – DiMeB – Digital Media in Education Research Group, Faculty of Computer Science and Mathematics, University of Bremen, for their friendship and academic hint. Thank to Michael Lund for translation of abstract in German. I would also like to show my gratitude to Suchitra Suvarnapradip and Somsak Saiyasombut. Thank you very much for their hospitality in Bremen.

Special thanks is reserved for Dr. Ilse Gierthmühlen for her endless support during my lifetime in Hamburg. I am also grateful to Annerose Heinrich and Dr. Janne - Stephan Gierthmühlen. Thanks for giving me the motivation, throughout my life in Germany, to get my dissertation done.

Convivial thanks go to all students for their participation in the class experiments. It is a great pleasure to thank everyone who helped me write my dissertation successfully. The Royal Thai Government financially supported this thesis; I am truly indebted and thankful to Thai people and King Mongkut's University of technology Thonburi.

And finally, but not least, thanks go to my whole family who has been an important and indispensable source of spiritual support. This thesis is dedicated to my parents – Prakob-Prateep Pusawiro. Notwithstanding all of the above support for this dissertation, any errors and omissions are solely my own.

I. INTRODUCTION

I.1. Background and Motivation

The learning environment and culture fosters the way people thinking and living. Most learning in school and university are frontal teaching and passive learning. The classroom is mostly one-way conversation. New education technologies are coming on stream, enabling connectivity among teachers, facilitators and learners. Learning no longer ends after lecture in classroom, as Internet-based technologies serve information exchange, file sharing, homework submission, and so on. A number of communication platforms have been deployed in most university-level courses.

This research explores the learning via the practice of using technology in education to evoke dialogues on tools to construct an effective learning environment in the classroom. Amid a large variety of technology-enhanced learning software available today, which includes the recently emerging tools like social software and the legacy tools used within a university such as Learning Management System (LMS), Managed Learning Environment (MLE), Learning Content Management System (LCMS), Virtual Learning Management (VLE) or just Courses Portal, all users must be aware that each software application is different in a variety of aspects such as software cost, license fee, target user group, capacity, scalability, extensibility, target platform, and the underlying development technologies. In addition to these realms, a learning tool should fit well to the learning model and philosophy of that course.

Based on *Constructionism* philosophy, this research aims to point out the problems in the heterogeneous educational technologies used at universities. It will demonstrate the importance of tool selection and integration into the classroom learning process. A hands-on of educational technology is experimented and re-designed to view the friendly functions and features currently available in educational software, according to *Conviviality* impression.

Most universities today rely on different learning software applications. Users, especially students, have to learn how to access and use a wide-variety of technology-enhanced learning environments each time they move to different course website. These barriers in grasping a new user interface can hinder the real understanding of the subject matter for a course.

Several case studies were conducted through different courses in the Digital Media masters program at the University of Bremen, Germany, during 2001 to 2006. Students worked in small groups to design digital media and computational tools that should make learning more interesting and meaningful for them. In doing so, the students collaboratively analyzed, evaluated, and rethought the tools used in the course with the goal of a new design specification for the ideal learning tools for that course.

In the experimentation, students alternated between acting as software designers and software users during the course. Students read and discussed the course material, conducted a hands-on project, shared their understanding, and then constructed the knowledge learned via a collaborative learning platform. Each student shared his or her experience with the technology via evoking dialogues on its tools.

To this end, this research proposes the concept of “*Constructing the Learning Environment*” and “*Convivial Computer Tools*” for higher education, where learners and teachers, via dialogues in the class, can deploy a set of selected tools and functions to match their learning needs through a common consensus. It is also to show that a tool with too many functions can cause confusion, rather than enhance effectiveness. For successful selection, it is crucial that students construct the learning environment on their own.

1.2. Research Questions and Objectives

One of the most significant current discussions on educational technology-enhanced learning and educational philosophy is learning awareness, interaction and collaboration. It is becoming increasingly difficult to ignore the social context and the constant emergence of new technologies towards the 21st century education software and new learning paradigm.

So far, however, there has been little discussion about constructionist learning process in higher education, especially the design of digital tools that aim to impact for the blended learning in campus. The extensive research has been carried out on constructionist environment and activities but to design a constructionist toolkit mainly for young people, not much research for students at higher education.

There is a wide range of technology available for learning; for example, learning management systems (LMS), content management systems (CMS) and other E-Learning applications used in the higher education or university level. For many years, great effort has been dedicated to unify and centralize these software applications, both the proprietary and open source types, in order to facilitate and enhance learning in a classroom – both collaborative learning and personal learning. However, students have shown a lack of interest in using university’s official software for communication and information sharing, while they appear more comfortable in exchanging ideas informally via simple social networking applications such as MySpace, MSN, Facebook, Ning, BigTent and so on. This, therefore, calls for a rethink of the pedagogical process towards blending together commonly used Internet tools and educational tools rather than developing new tools for the classroom. This study aimed to address the following thesis questions:

1. How should educational tools look like to become convivial tools for higher education in order to enhance an interactive, collaborative, and personal learning environment?
2. How can electronic learning environments in higher education been used in order to raise awareness for the learning process and to foster constructionist learning?
3. How will participants — students, teachers, and tutors — be encouraged to effectively interact with each other? How will they network and share common classroom activities?
4. What procedures are needed to ensure the effective use of tools in a classroom and how to organize these tools to fit, but not to force, a student’s use?

The main objective of this study is to propose the concept of “*Constructing the Learning Environment*” and to develop an understanding of “*Convivial Computer Tools*” suited for higher education where students have choices and discussions on the deployment of the appropriate tools in order to construct convivial tools on their own.

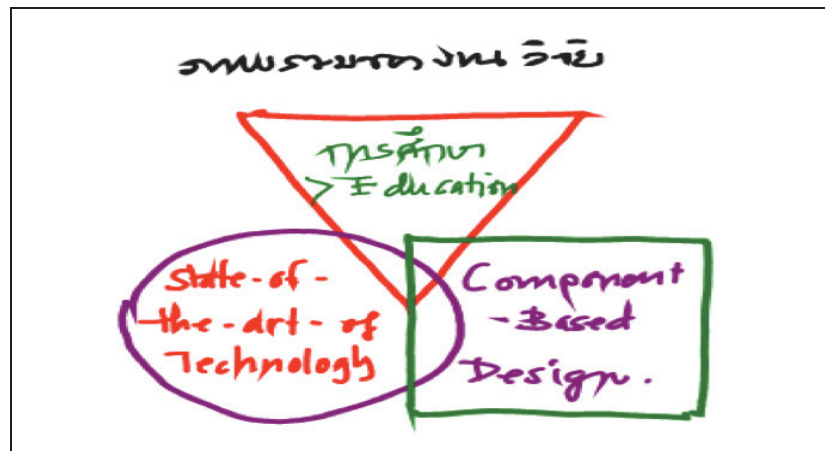
1.3. Methodologies

This dissertation follows a case-study design experiment, with in-depth analysis of co-designing the ideal learning portal and classroom environment. Data were gathered from multiple sources at various time points during the 2001–2006 academic year. Moreover, this study was exploratory the state-of-the-art learning platform technology. Thus, the research evidences in this thesis are drawn from two sources:

1. Classroom experiments and case studies: participatory software design and dialogues in the classroom.
2. Current success cases: review of trend analysis in the use of social networking tools in higher education.

In doing so, this research, (1) studied the range of learning theories which could be applied to design a campus computational platform – *Constructionist Learning, Tools for Conviviality and Higher Education*; (2) investigated and tests the possible existing and emerging digital tools which are state-of-the-art technology enhanced learning. Likewise, the research explored and experienced from the emergent of learning software platforms nowadays; (3) analyzed and compared those lessons learned from previous phases deriving from the concept of software analysis and design development, then (4) blend the paradigms together as summarized in Figure 1.

Figure 1 : Components of Research Framework



All these have done by literature survey as a secondary data. In addition, several case studies have been conducted in order to get a primary data. The related literatures are surveyed from different research communities; namely Learning in *Higher Education*, *Technology in Education*, *Learning sciences*¹, *Computer-Supported Collaborative Learning*², *Technology Enhanced Learning*, *Component-based Software Engineering* and *Software Architecture*. The exploratory of different existing tools have been installed, hand-on and tested via the case studies at University of Bremen.

¹ The International Society of the Learning Sciences (ISLS): <http://www.isls.org/>

² International Journal of Computer-Supported Collaborative Learning: <http://ijcsl.org/>

1.4. Contributions and Constraints

Within the higher education context, this work proposes the learning guidance in the deployment of educational tools. Our focus is more on learning process, partly on teaching process. Instead of building a new learning platform, this research focuses on the discussions and negotiation processes to arrive at appropriate classroom tools through *Constructionism* and *Conviviality*. In order to enhance the classroom-learning process, the tools will be objects-to-think-with and serve as learning artifacts. Thus, our innovative attempt is to bring constructionist learning into the higher education context. The classroom environment will provide students choices and let them select software tools via dialogic and collaborative processes at the beginning of each semester. Students can then co-construct convivial tools on their own.

Due to practical constraints, this paper cannot provide a comprehensive review of constructionist learning assessment in higher education. It is beyond the scope of this study to examine the pedagogy of assessment – the quality assessment of conceptual understanding, learning performance and class satisfaction. Future studies on the current topic are therefore recommended. Also, the current study has only examined with a small class size, the move towards bigger classes, thus a new model of design experiment might be undertaken. Last but not least, in the future, more broadly research is needed to determine the advantages and disadvantages of campus learning environment and software infrastructure at university.

1.5. Outlining the Structure

The overall structure of the study is composed of seven chapters, including this introductory chapter. This chapter has provided the background to this study and the research questions, objectives, methodologies and brief contributions. The rest of the dissertation consists of two logical facets; first, chapter Two, Three and Four review the theoretical frameworks and research literatures; second, chapter Five explains the case-study methodologies and experimentation that implemented from previous theoretical chapters and chapter Six wraps up the results and describes the detailed contributions of this work. Chapter Seven recaps the whole dissertation. The particulars sequence is summarized as follows:

Chapter Two begins by laying out the theoretical dimensions of the research, and looks at why it is important to understand *Papert's Constructionism* and *Illich's Learning Webs* before the design of learning process for technology enhance learning. We present how these theories related to the use of technology in education in order to design and construct an effective learning environment suited for higher education. It is aimed to show how to support learners for interactive and personal learning environment via the use of computer tools.

Chapter Three is explored the influences and roles of technology in education. We examine the pedagogical meanings and perspectives on constructionist learning tools. We describe the design aspect of the convivial learning environment and examine the impact of technologies on social context. This chapter surveys on the evolution of technology-enriched education and emerging technologies such as Web 2.0 and social software and then discusses the construction of effective learning environment as convivial tools for students in general.

Chapter Four is scoped the idea about student learning at university. Our focus concerned with the purpose, characteristics, and specification context of higher education for this study. Then we examine the academic teaching and learning and survey what kind of Information and Communications Technology (ICT) has been deployed for electronic learning environment at campus-level. Finally, we bring together the ICT and learning processes to chart out a direction for constructing the learning platform in higher education.

Followed by the Conclusion: Foundation Section, we summarized how important of Chapter Two-Three-Four is, regarding technological trend in education and then we explain how we inject aforesaid foundation into research design experiment.

Chapter Five explains the methods used for conducting the research and for the analysis of the data in this study. It describes the study sites and participants, focusing on the three courses undertaken at University of Bremen. It concerns the procedures used, the instruments for data collection, and the design experiments and the case-study methodology used for this study. A feasibility study was conducted to find the possible learning environment in each course whereby class process and in-class dialogue was observed.

Chapter Six presents the findings and recommendations of the research. This chapter is the contributions of this work. It draws upon the entire thesis, tying up the various theoretical and empirical strands in order to identify how the electronic learning environments can be used and what procedures are needed to ensure the effectively use to interact and collaborate in classroom. It associates the scenarios and components of *constructing the learning environment with the convivial computer tools*.

Finally, Chapter Seven, the conclusions and discussions give a brief summary and recap of the findings. It includes a discussion of the implication for further research. Finally, areas for further research and future design are identified.

At the end, Appendix A gives more details about the original course syllabus of each experiment. Then Appendix B illustrates the collaborative project and original data script of knowledge building threads from the course 2: Re-thinking Digital Media – Engaging Learning. Lastly, Appendix C shows the original data collection from Stud.IP discussion forum regarding the course 3: Learning in Digital Spaces.

2. EDUCATIONAL THEORIES AND LEARNING WEBS

Studying educational theories is the priority to design and implement the learning environment into a classroom. This research investigates the teaching and learning approaches that augment the use of a computational environment, so that students can construct the efficient learning environment.

This chapter deals with the theories related to the use of technology in education. It is aimed to show why it is important to understand such theories before the design of learning process for a technologically rich environment. Through the theories, we will understand how people learn, how learning takes place, and how to support learners to learn both individually and as a group via the use of computer tools. For this learner-centered concept, our focus is on the philosophies of *Constructivism* [Piaget, 1972], *Constructionism* [Papert, 1980], and *Learning Webs* [Illich, 1971], as their approaches have the learner at heart and are still up to date in this digital age. In this thesis, such educational theories are blended as a foundation framework in order to design and construct an effective learning environment suited for higher education.

2.1. Importance for Technological Learning Environment

2.1.1. Context of Learning Environment

This research recognizes the learning environment as a place, which supports both the teaching and learning processes. It is a place and setting where learning occurs via educational technology. However, it is not limited to a technological environment or even a virtual environment, but also includes the physical classroom setting. Indeed, it is a companionable environment that activates the educational process for students, teachers and other participants including tutors, researchers, and computer staffs.

This thesis aims to construct an effective learning environment with appropriate computer tools. With the learning design process in mind, we may combine various technological media and computer tools into the learning platform. And that requires understanding of various educational theories, to select the supportive tools.

The use of Information and Communication Technology (ICT) is prevalent in schools, colleges, and other learning institutions. Most computer centers install and maintain ICT services both inside and outside the classroom as a basic infrastructure for such an organization. The infrastructure can support the learning environment, if computational learning tools available to students or groups of students can support information exchange or class activity sharing.

At the campus level, a commonly installed application by the ICT service center is the so-called Learning Management System (LMS) or Learning Content Management System (LCMS) or just University Portals, to support classroom learning. The infrastructure platform allows students to track a collection of courses, access the course materials, and manage their learning for both self-learning and group-learning. Effectiveness however relies on the functionalities of that software and the learning methods, styles, and activities of the students.

For an effective learning, we seek to understand the relevant educational theories that support and empower students in using such software tools. This research points to students' usage of computers to enhance their learning and points the way how to achieve the right deployment of computer technology where students can communicate among each other, access the course material, and share ideas in order to improve their learning.

2.1.2. Design of Technological Tools and Learning Settings

To design the appropriate learning environment, the learning objectives and outcomes should be set out clearly to ensure appropriate tool usage. With new tools against traditional teaching environment, the effectiveness will be low. In this thesis, we seek to understand the educational concept behind the technological tools and explore the pedagogical process in effectively using them. Too often, tools have been designed to empower learners, but it only ends up being used in the same old disempowering ways. Since ICT has well-penetrated the classroom, software tools are increasingly available to students for communicating and working together, especially for project-based learning or group-work.

We have observed that for effectiveness, when a new tool is introduced, we need clear understanding of the pedagogical process in using that tool and its learning environment. The learning principles behind digital media technologies influence the design of such learning setting and provide new learning experiences.

Technology can be used to create new content that simulate effective learning. The emergence of ubiquitous computing allows students to truly learn anywhere and anytime. It also provides opportunities to students in promoting either peer-to-peer or self-paced learning. Thus, the better we understand education systems and pedagogical manners, the better we can fill the gap for deploying appropriate technology into the classroom. It is crucial to ask "what is the appropriate approach to use computer tools in education?"

Progressive learning scientists, like Papert, suggested that computers should serve as a facilitating role in helping learners gain experiences on deep learning. For example, computers can help learners collaborate, reflect on their own learning, or develop knowledge. Since learning and teaching involve motivation, in the rest of this section we explore the appropriate learning theories that may foster the construction of an effective learning environment suited for the learner-centered culture.

2.1.3. Exploration of Education: Learning and Teaching

According to educational philosophy, education involves the acquisition of a body of knowledge and understanding that surpasses simple skill, know-how, or collection of information [Phillips, 1985]. Such knowledge and understanding must involve the principles that underline skills, procedural knowledge, and information. The knowledge must transform the life of the person being educated. The process of education involves at least some understanding of what is being learned and what is required in the learning [Phillips, 2008].

In brief, the *How people learn: Brain, mind, experience, and school* book explains that "Learning" is fundamental to education. To learn something successfully is an

achievement. "Teaching" is an intentional process that has a variety of pedagogical techniques. There is a conceptual connection between learning and teaching, but learning can also take place without any teaching [Bransford et al., 2000]. If we can understand general principles regarding how students learn, this may help us design pedagogical approaches, which would facilitate successful learning in a technological rich environment, according to the book.

Regarding the terminology from the *Encyclopedia of Education*, the premise foundations in education are epistemology and pedagogy or the combination of learning and teaching techniques [Siegel, 2008]. Empirically, learning theories have various factors that influence both the teaching and learning processes. One of the influencing factors is the use of a technologically rich environment.

To empower the learner is to build their understanding of the subject matter. We, therefore, focus on supportive learning activities. These activities may occur and interact both individually and collaboratively via a consensus on the appropriate computer tools to be used.

With reference to our experiments in chapter 5, we observed the way students applied technology for effective learning in their individual circumstances. Meanwhile, we observed the way students used computer tools to achieve their learning goals. Specifically, we examined the feasible methodologies that may promote the use of technologies in the construction of an effective learning environment.

2.1.4. Constructivism, Constructionism and Learning Webs

How students learn, how learning takes place, and how to support students to learn both individual and together are the principles of this research. We study key learning theories to understand how students learn the subject matter, how they share their knowledge, and in which way they interact efficiently via digital technologies. Subsequently, we explore the educational perspectives of *Constructivism*, *Constructionism*, and *Learning Webs*, all of which focus on the use of technology as a learning media and for social linkage.

Although there is no complete solution to optimize learning in a classroom environment, we apply and blend the following educational theories as a framework in this research because they, as referred by researchers in the educational technology field, can enable effective learning in a technologically rich environment.

Constructivism [Piaget, 1972]:

Piaget (1896-1980) studied developmental psychology and genetic epistemology. In 2009, he was named as thinkers and scientists in *Time Magazine's* 100 most important people of the 20th. As published in *Understanding Psychology* that "he found the secrets of human learning and knowledge hidden behind the cute and seemingly illogical notions of children ... children are not empty vessels to be filled with knowledge (as traditional pedagogical theory had it) but active builders of knowledge" [Papert, 1999a]. Interestingly, he established a framework that affects the way to train teachers and to teach students.

Constructionism [Papert, 1980]:

Papert (1928-) considered using technological tools in mathematics to help us understand how children can learn and think. He is an expert on both children and computing. His work focuses on tangible tools. He also created the LOGO programming language for children and used “turtle” as a metaphor of an object-to-think-with in such programming. He described learning environments that children learn collaboratively via a meaningful projects and powerful ideas. The computer serves as a learning instrument via the metaphor “computer as pencil” that carries and spreads the ideas and social relations embedded within them amongst a group of people.

Learning Webs [Illich, 1971]:

Illich (1926-2002) argued that a good education system should facilitate learning exchanges in order to enable students to gain access to any educational resources that may help them to define and achieve their own goals. He called such approaches “*the educational or learning webs*” in his *Deschooling Society* book. Today, such learning webs idea can be considered analogous to internetworking in a computer-based education. He emphasized that students conceive a different style of learning and they are learning many things outside of schools. He claimed that “most learning happens informally even in formal educational institutions” [Jamie, 2009]. As a consequence, instead of traditional schooling, he believed that “the ideal education system allows people to choose what they learn and when they learn” [ibid]. In other words, he believed a better way to encourage learning is to provide choices to students. As we have the Internet and social networking, such network possibly provides us alternative learning resources and connects us to other knowledge experts.

The theories are blended as a design guideline for a learning environment in the higher education context. In the next section we explain these educational frameworks in detail. In a later chapter we explore the relations of these theories to the technological aspects. In chapter 4, we focus on learning approaches as related to higher education level. Then, in chapter 5 we show how we implemented and integrated these ideas into the design of our experiments for our case studies.

2.2. Constructivism

The main focus of this research is the learning environment in which students can actively construct their own computer learning tools. For an appropriate learning environment, we support the learning doctrine of Constructivism. According to Piaget, he believed that students are active learners; therefore we should not treat them like empty vessels to be filled by teachers during the knowledge development process [Piaget, 1972]. He affirmed that the subject of knowledge builds up all knowledge from scratch [Piaget, 1962]. Moreover, his constructivist theory of learning stated that people learn by constructing their own cognitive structures based on their previous knowledge and environment [Piaget, 1977a].

We found that Piaget focused on concepts of learning based on the study of children’s views and the conceptual changes in children. He asserted that all development emerges from action, so that individuals construct their knowledge of the world as a result of interactions with the environment. Thus, all knowledge is constructed, neither received nor innate; it comes from the study by the knower. In the same way, the

knowledge construction is not learned by simply internalization from outside to inside, but by a development of personal process.

Piaget also identified the structure of the mind underlying the cognitive behaviour in each stage of mental development, and developed the theory of cognitive assimilation, accommodation, and adaptation schema. The schema is used for constructing meaning and developing the thought process. This schematic development leads each individual's ability to assimilate and accommodate, and act on new information. It is a stable equilibrium between assimilation and accommodation. He explained such a process as an equilibrium condition [Piaget, 1962] [Piaget, 1977b].

During 1960s to 1970s, Piaget's work became widely influential in education. Before Piaget, most people held to the commonsense belief that children have less knowledge than adults. Piaget argued a radically different theory. Although children certainly possess less knowledge than adults, their minds also contain different knowledge structures from adults. In other words, children differ not only in the quantity of knowledge they possess, but their knowledge is also qualitatively different.

From the point of view that teaching is always indirect, we should empower learners to be active participants in the learning in order for them to construct knowledge on their own rather than being passively instructed by a teacher.

2.2.1. Active Learning and Meaning Making

Concerning education philosophy, constructivism has been referred to as an epistemological subject that

"[Piaget's] work appealed to many educators who believe that children must be active in their own learning. Educators began to distinguish "developmental learning" from "rote learning," the former being described as active and making a lasting difference in how students approach problems and new situations, the latter described as passive, temporary, and useless for further learning. [Noddings, 2007, 115]"

Such epistemology is a structure resembling a matching program that can account for the cognitive behaviour that identifies the structures of mind and characterizes the stage of mental development [Audi, 2003].

This is a conventional transmission model. Actually, learning takes place not only in the direction from teacher to students, but also among the students. Hence it is worth to consider resistances to learning, considering whether a child is interested or resistant to the learning.

In literature reviews [Noddings, 2007], the implication of Constructivism supports our experiments on why students often do not learn deeply by listening to a teacher, or reading a textbook. As other researchers revealed a deeper underlying basis of how knowledge construction works within each student. They recommended that we need a very good understanding of what students know when they come to the classroom in order to design an effective learning environment [Siegel, 1998]. In other words, the experience, pre-skills, and knowledge of students are meaningful factors in designing the technology tools for learning.

We recap that the constructivist environment deemphasizes lecturing and telling. Therefore, we should encourage students to establish and pursue their own learning objective. To promote active learning is to facilitate students' learning and to motivate the active engagement of students. Likewise, teachers need to know what and how students are thinking via meaning making. Indeed, such a process is the "Let me hear you think. [Noddings, 2007, 116]" approach, as referred to Piaget.

Noddings further researched the idea for active learning and meaningful learning. He explained that the process of meaning making involves encouraging students to think aloud. The researchers agree that students are capable to learn a new thing based on what they already know through the problem-solving activity and feedback, and the use of active learning instead of passive learning. If we can share such meaningful thinking, then we may know how to motivate their learning through the learning environment.

2.2.2. Equilibrium Mechanisms

The development of the constructivist knowledge is based on the mechanisms known as assimilation and accommodation, which are part of a process called equilibrium [Piaget, 1977b]. This process considers an individual stage in which

"[Learners] construct a broad structure of knowledge through the association of ideas, interaction with objects, and the transmission of information received from the environment. If this structure is not consistent with live experiences, then a constructive error is characterized, and this makes the individual to react to the assimilation. In this case, the individual should begin to reconstruct his hypothesis to a point where the new data may be completely assimilated. This is the mechanism known as accommodation, where "the individual begins to change as a consequence of resistance imposed by the object". The constructive error applies in an unbalanced situation, which in turn generates a new intellectual action to reach a new equilibrium. [Maia et al., 2005, 220]"

Indeed, it is learning via the trial and error mechanism. There are also several studies based on the understanding of that equilibrium. Researchers explained that learning is "a constructive process in which the learner is building an internal representation of knowledge [based on] an interpretation of personal experiences" [Bednar et al., 1991, 91]. The dynamic representation based on this error is a necessary step towards cognitive development. Furthermore, it is comparable to the recursive process in the software analysis and design methodology (more will be discussed in our design of effective learning environment section of chapter 5). Accordingly, we found that such mechanism is similar to the debugging process in computer sciences when we write, compile, debug, execute and correct a software program.

We conclude from our literature survey that the interdisciplinary research on psychology, linguistics, anthropology, neurosciences, and computer science has widely adopted the educational practices based on this constructivism idea. In summary, the thought of constructivism is recognized as an appropriate epistemology to deal with the composite, vague, and contemporary education.

2.2.3. Social Context in Constructivism

As mentioned earlier, constructivist surveys focus on the individual learner. On the other hand, there are social aspects that view learning as connection with the socio-cultural context. The mainstream of this social constructivism relies strongly on “the activity theory” [Vygotsky, 1978]. He explained additionally that student learning presupposes a specific social nature and process by which students grow into the intellectual life of those around them and then became part of their nature and culture [ibid.]. The significant work of Vygotsky is in embedding the learning into everyday cultural practices. He linked formal and informal learning environments by promoting social interaction that connected the students with their life outside the classroom.

According to Duffy and Cunningham, they differentiated Piaget from Vygotsky in the context of socio-cultural and activity theory [as cited in Mayes and Freitas, 2004]. Piaget’s constructivist theory of knowledge is based on the assumption that learners do not copy or absorb ideas from the external world, but must construct their concepts through personal experience, active engagement, self-experiment and observation. On the other hand, Vygotsky’s social constructivism is based on the assumption that knowledge is transferred among learners by watching others work. For this reason, Vygotsky extensively studied cognitive psychology, pedagogy, and the socio-cultural context.

The extended research in social constructivism has root in both the individual psychological development and educational philosophy in a social context [Phillips, 2000]. The former views constructivism as how an individual learns where knowledge is actively created or constructed by the learners. Similar to Piaget, the focus is on the individual learner and the construction of meaning. The latter emphasizes the influences of social and interactive culture on an individual’s learning.

Von Glasersfeld studied a more radical and modern constructivist. He claimed all cognitive activity took place within the experiential world of a goal-directed consciousness [von Glasersfeld, 1996]. Though his work has been influenced by cognitive theories, this learning theory incorporated the learning in terms of active learning.

To end this section, we found that the constructivist approaches concern the notion that learners build knowledge through personal experience and develop their ability into the real world contexts. The constructivist process creates a relationship among the object, the knowledge, and the knower. Constructivists focus on the transformation of knowledge, instead of the transmission of it. Furthermore, such an idea may be engrained in situated and authentic learning in project-based course. In other word, the emphasis is on active learning rather than passive learning. With respect to constructivist epistemology we believe in the knowledge transaction model rather than the knowledge transmission model. This transaction model serves as an alternative education model, promoting a learner-centered learning model. Learners should engage and participate in the learning environments that help them create a personal view of their learning. In the next section, we study the extension of Constructivism to the technological context of the so-called Constructionism. We pay attention to the roles of educational technology. We explore the constructionist-learning environment that may engage students in actively constructing external and sharable artifacts during the learning process.

2.3. Constructionism

The educational philosophy of constructionism emphasizes that learners are likely to construct new ideas when they are building artifacts that they can reflect upon and share with others in their learning community [Papert, 1980]. Based on the Constructivism of Piaget, Papert coined the term Constructionism and extended that knowledge is not passively received either through the senses or by way of communication. On the contrary, the cognitive subject actively builds up knowledge. The constructionist process emphasizes hands-on and project-based methodologies. Such processes encourage the learner to build things in order to become aware of understandings by thinking about understandings; that is, to make them explicit [ibid.].

N-word and V-word

Importantly, Papert explained that the constructionist learning is going beyond constructivist learning in several aspects, especially in engaging external and sharable objects. He clarified that

“We understand ‘constructionism’ as including, but going beyond, what Piaget would call ‘constructivism’. The word with the ‘v’ expresses the theory that knowledge is built by the learner, not supplied by the teacher. The word with the ‘n’ expresses the further idea that this happens especially felicitously when the learner is engaged in the construction of something external or at least shareable ... a sand castle, a machine, a computer program, a book. This leads us to a model using a cycle of internalization of what is outside, then externalization of what is inside and so on. [Papert, 1990, 3]”

Furthermore, Papert clarified the difference between the ‘N’ word and ‘V’ word again in his “Situating Constructionism” article:

“Constructionism – the ‘N’ word as opposed to the ‘V’ word – shares constructivism’s connotation of learning as “building knowledge structures” irrespective of the circumstances of the learning. It then adds the idea that this happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity. [Papert and Harel, 1991, 1]”

2.3.1. External and Shared Artifact

Shared artifact is a key in constructionism. Papert extended the idea of constructivism to which children learn best when engaged in actively constructing objects or external things, then share them with others [Papert, 1991] [Resnick, 1996a].

According to Harel, she restated on Piaget’s view on education that teaching is always indirect, not by being [Harel, 1991]. Moreover, Piaget studied what children are interested in and able to achieve at different stages of their development, according to [Ackermann, 2001, 3] in order to understand children’s ways of working and thinking. As a consequence, knowledge is experience acquired through interactions with the world, people and things. On the other hand, Papert argues that constructivism has overlooked the role of context, uses, and media, especially regarding individual preferences or styles, according to [Ackermann, 2001, 4].

Regarding artifacts, Papert believed that learners learn when they are “engaged in the construction of something external or at least shareable” [Papert and Harel, 1991, 3] – a continuous cycle of internalization to externalization. Thus, externalization and internalization in constructionism are interrelated. Similarly Ackermann explained cognitive growth as an ongoing dance: “diving-in and stepping-out”. She said this learning process is a cycle of the internalization and externalization processes [Ackermann, 1996, 28].

To explain external objects, Papert gave an example from his own childhood experiences when playing with gears and cogs. Such stuffs served as objects-to-think-with for him. He got more understanding about implicit mathematics via explicit objects that empowered him to understand about ratios, equations, and powerful maths idea in a concrete way.

Constructionist researchers after Papert experimented intensively on objects and artifacts. Kafai and Resnick affirmed that constructionist theory goes beyond constructivism. They investigated the role of artifacts and found that meaning-construction happens particularly well when learners are engaged in building external and sharable artifacts [Kafai and Resnick, 1996].

In *Constructionism in Practice* book [Kafai and Resnick, 1996], the researchers advocated constructionist perspectives that we learn better, when we work together on project, share ideas explicitly and represent them via artifacts. The interaction process amongst learners and with objects enabled learners to share new idea and get more understanding about concepts and contents. An objects-to-think-with represents meaningful and important concepts and facilitates learners to create new ideas through their interactions with each object, according to Papert.

Expressing ideas makes them tangible and sharable, sharpens these ideas, and helps learners to communicate with each other through their expressions from the inner to outer manner. The cycle of self-directed learning is an iterative process by which learners invent for themselves and express their knowledge via tools and digital media. Notably, Papert believes that computer technology play a vital role in education. He used technology as a key media of the constructionist-learning environment. He argued that knowledge is not passively received either through the senses or by way of communication, but is actively built up by the cognitive subject. Computers can provide a powerful understanding. He believes the learning will occur through the computer embedded environment and through using technologies [Papert, 1991]. However, he posed the question whether the technology determines how people think or how people think determines what technology they make [Papert, 2000].

For us, we view computer tools as the external and shared artifacts among students in the classroom. The tools are an object-to-think-with. We have to keep this in mind when designing and using technological tools. If students share and learn via computer tools in the learning environment, we hope to enable students to learn any subject meaningfully and construct new ideas through their interactions via such tools in the learning environment, according to constructionist concept.

2.3.2. Social Context in Constructionism

Though the early work by constructionism focused on the individual, the constructionist learning environments actually encourage multiple learning styles and multiple representations of knowledge [Kafai and Resnick, 1996, 3]. Later, researchers in Constructionist learning extended their experiments from individual learning to the social context or community learning aspects such as in the project MediaMOO and MOOSE Crossing in virtual communities [Bruckman and Resnick, 1996] (see more in chapter 3).

The classic example of Papert's social learning environment in the real-world community is the samba school in Brazil where might be used as models to create learning environments that support the use of the computer in a way compatible with his ideas. He said "one that helps us not only to learn but to learn about learning" [Papert, 1980, 177]. One of such models discussed is the Brazilian Samba School, as a social organization formed for a specific purpose. The school consists of a few hundred to a few thousand people of various ages who work together as collaborative co-learners to put together their performance. Papert explained that

"A very remarkable aspect of the Samba School is the presence in one place of people engaged in a common activity - dancing - at all levels of competence. ... The fact of being together would in itself be "educational" for the beginners; but what is more deeply so is the degree of interaction between dancers of different levels of competence. From time to time a dancer will gather a group of others to work together on some technical aspect; the life of the group might be ten minutes or half an hour, its average age five or twenty five, its mode of operation might be highly didactic or more simply a chance to interact with a more advanced dancer. The details are not important: what counts is the weaving of education into the larger, richer cultural-social experience of the Samba School [Papert, 1976]."

Bruckman has further studied such social learning similar to the samba school. She researched the social interaction and community building via playing computer games called MUDs, MOOSE Crossing, and the MediaMOO from which she explained:

"Social context is of central importance to any learning experience. One of the strengths of networked learning environments is their ability to help integrate a supportive social context with the computational context [Bruckman, 1997, 117]."

Additionally, Bruckman argued that

"A particularly felicitous type of community often emerges when people are brought together to construct things. ... [Samba schools] is characterized as a constructionist culture [Bruckman, 1997, 159]."

Another social aspect of constructionism studied by Shaw presented types of social constructions taking place and shared within a physical community; namely, social relationships, social events, shared physical artifacts, shared goals and projects, and shared cultural norms and traditions [Shaw, 1994].

Another social context is distributed constructionism introduced by Resnick via StarLOGO tools. He explained in this paper that

"Distributed constructionism extended constructionist theory, focusing specifically on situations in which more than one person is involved in the design and construction activities ... [This is] a particularly effective way for knowledge-building communities to form and grow through collaborative activities that involve not just the exchange of information but the design and construction of meaningful artifacts. [Resnick, 1996a]"

Through social interaction and computer network, he added three additional main activities to constructionist learning environment that help learners in knowledge building process. The activities are discussing constructions, sharing constructions, and collaborating on constructions [Resnick, 1999].

Another example is a video-games project designing via on computer network that allowed elementary-school students to share ideas via newsgroup [Evard, 1996]. Students can share ideas and get quick answers regarding technical problem, when they posted questions online regarding their project activities. Thus, good design ideas spread through the class more rapidly via co-constructing process.

The human learning theories related to this work are on knowledge construction, not on knowledge recording or absorption. The learning, however, is affected strongly by motivation. Thus, the key issues in this thesis are how to customize the tools to suit each situation using appropriate technology and how to enhance interactions among learners in both the physical world and the virtual world. Central to the constructionist principles is the need of a community of learners to share projects and explore ideas. Some research has focused on face-to-face learning communities, while others have explored a different form of online learning and sharing communities (cf. [Bers, 2001]). A constructionist approach to communities maximizes each individual's opportunity for learning through creative expression and content production via the network of learners.

Researchers in the constructionist camp have investigated how an immersive computer-learning environment can support self-selection and self-authorization. In these experiences, they concluded that technologies draw students into a higher level of mutual respect and collaboration providing an increased sense of autonomy, interpersonal awareness, and confidence in their learning [Bers and Urrea, 2000]. Through learning via technology, researchers of constructionism are finding out how learners engage in a conversation with their own artifacts or others people's artifacts as we can see from the constructionist environment [Cavallo, 1996] [Cavallo, 2000] [Butler et al., 2000] [Bers et al, 2006] [Sipitakiat and Cavallo, 2008] [Katterfeldt et al., 2009]. In our research, we also employ the conversations and dialogue approach [Bohm, 1996]. We investigate how these conversations boost the dialogical learning environment, and ultimately facilitate the co-construction of tools related to the way one learns. We study and explain more on the technological aspects of this issue in chapter 3.

As mentioned in an earlier section, *Papert's Constructionism* focuses on the art of learning, learning to learn, and making things in learning. When learners construct something, it will be their artifact that functions as an object-to-think-with. We have

seen that various constructionist learning takes an epistemological perspective view not only at understanding the nature of how learning happens, but also at producing a change in the way people learn by means of using the computer as a powerful tool to support new ways of thinking and learning both individually and socially.

In chapter 5, we examine such arguments in more depth through our case studies. We employ the concepts on objects and artifacts to design our research experiments for higher education. Moreover, this overlaps with the study of learning through participatory design and project-based learning. As expected, we use technologically rich experiments to construct an effective learning environment.

Correspondingly, in our research, we also focus on the way learners use technology in the manner used in the constructionist learning environments. We explore more on the use of computer technologies in the context of higher education. In addition, we suggest the design of constructing the learning environment with these goals in mind as presented in chapter 6.

To conclude this section, we have explained constructionism philosophy and other related concepts in this chapter. Furthermore, we provide more details in connection to the technologies in the next chapter. In chapter 5, we show how we conduct experiments about the learning environment and how we deploy tools as an object-to-think-with in constructionist setting. All these powerful ideas will be revisited and executed as a guideline for the *Constructing the Learning Environment* and *Convivial Computer Tools* in chapter 6. In the next section we explore another revolution in education that can relate constructionism to networking technologies through providing the opportunity for all people to transform their lifestyle into one of learning and sharing via the learning network.

2.4. Learning Webs

Illich had once alluded to a *Learning Webs* idea in his *Deschooling Society* book [Illich, 1971, 72]. He proposed that people should have access to the resources they need. His book implied that the good educational system might be sustained by the interlinking mechanism, like distributed network nowadays. His idea instigated for radical changes in decentralizing the education system. He stated that people conceive a different style of learning. Considerably, students are learning many things outside schools via the informal *learning webs*. The idea of learning webs is still considered modern and timely in today's world. The emergent of the Internet has enabled the interconnection a huge network of resources for students. Moreover, Illich referred to educational webs in the introduction part that

"The current search for new educational funnels must be reversed into the search for their institutional inverse: educational webs which heighten the opportunity for each one to transform each moment of his living into one of learning, sharing, and caring. [Illich, 1971, xx]"

The work of Illich invoked radical and revolutionary changes in the education system. His avant-garde idea for that time was the development of a more informal learning, as he claimed that most learning takes place informally. Impressively, he wrote a good manifesto in his book *Deschooling Society*.

"A good educational system should have three purposes: it should provide all who want to learn with access to available resources at any time in their lives; empower all who want to share what they know to find those who want to learn it from them; and, finally, furnish all who want to present an issue to the public with the opportunity to make their challenge known. ... It should use modern technology to make free speech, free assembly, and a free press truly universal and, therefore, fully educational. [Illich, 1971, 75-77]"

For decades, mostly the alternative education, charter schools, and the un-schooling or home-schooling movement have adopted his revolutionary idea. We also view his ideas as in line with this thesis, as an alternative way in designing the learning environment. We explore the feasibility of learning webs in detail by using digital technology to connect students with the educational resources they need via ICT, especially the Internet.

To confirm that his idea is contemporary and practical, we found that several websites reviewed and republished his book; the following is one example posted by Jamie:

"Illich envisions a better way to encourage learning. Instead of traditional schooling, he believes that people of all ages should be able to choose what they learn and when they learn it. ... Illich proposes that informal education can be supported through four services: libraries that store the materials needed for learning, skills-based exchanges where people can develop specific abilities, peer-matching that allows learners to meet others interested in studying the same subject, and a database of educators available for assistance. [Jamie, 2009]"

A great deal of learning appears to be a by-product of some other activity. With the increased use of Internet technology, the most radical alternative to school would be a network or services that give each student the same opportunity to share his or her current concern with others. Students admitted that, as an alternative to learning, they learned and acquired knowledge from friends or peers. Teaching guidance helps in some cases, as Illich suggested:

"Educational resources are usually labeled according to educators curricular goals. I propose to do the contrary, to label four different approaches, which enable the student to gain access to any educational resource, which may help him to define and achieve his own goals:

1. Reference services to educational objects - which facilitate access to things or processes used for formal learning. Some of these things can be reserved for this purpose, stored in libraries, rental agencies, laboratories and showrooms like museums and theaters; others can be in daily use in factories, airports or on farms, but made available to students as apprentices or on off-hours.

2. Skill exchanges - which permit persons to list their skills, the conditions under which they are willing to serve as models for others who want to learn these skills, and the addresses at which they can be reached.

3. *Peer-matching - a communications network which permits persons to describe the learning activity in which they wish to engage, in the hope of finding a partner for the inquiry.*

4. *Reference services to educators-at-large - who can be listed in a directory giving the addresses and self-descriptions of professionals, paraprofessionals and free-lancers, along with conditions of access to their services. [Illich, 1971, 78-79]"*

Illich also used the words "opportunity webs" for "network" of things, models, peers, and elders. Such a network is designed a specific way to provide access to those four educational resources. As shared with the work of Sipitakiat, the implication of *Deschooling* is to persuade the learner to find the time and the will to learn [Sipitakiat, 2001]. In doing so, we interchange the term *Learning Webs* to *Social Network Webs* and develop a sample social networking software to suit a technologically rich learning environment. We would like to reinforce the opportunities for all students to transform each moment in their living into their learning and sharing through the concept of learning, educational, and social network webs.

Since state-of-the-art technologies and information processing theory allows educators to embed computational tools, we integrate the learning webs concept with available digital networking. So these factors allow learners to inquire more knowledge from the network of expertise that may help students in either project-based learning or self-motivated learning. We should provide a shared environment that permits students and teachers to sustain exploration and enable them to understand the kinds of problems and some opportunities encountered by experts in various areas. In promoting this, we may alternatively use the social networking software as a computational tool in a classroom. Such software may connect people from various experts. Social networking can connect classrooms to external resources and transform the classroom into a more advanced context [Moll and Greenberg, 1990]. Besides, Lemke discussed his perspectives on learning and connected ideas amongst human, social and cultural change that

"Learning is not an internal process. People participate in larger systems ... in interaction with their own relevant environments. ... What fundamentally changes, what we call learning, is how people interact with and participate in the larger ecosocial systems that sustain them. [Lemke, 1993]"

The case studies in chapter 5 demonstrate that the necessary social relationship outside classrooms can establish systematic ways of learning within the classroom and can enhance the transaction of knowledge among participants, especially students. Furthermore, we suggest providing a common room as a physical learning environment. This physical place offers a social support environment for students in order to explore and use technologies [Schelhowe, 2007]. Students can come to meet face-to-face and hold discussions there. This room can possibly be an alternative place that creates a robust social system during the course. As a consequence, in chapter 6, we suggest to give a choice and pedagogical guide for students to select the convivial learning tools at the beginning of the class. In this manner, a good design of the physical environment can produce powerful learning environments since much of the strength comes from informal learning or out-of-the-class learning.

2.5. Conclusion

Inspired by *constructivism*, *constructionism*, and *learning webs*, we agree that students should be active participants in the learning process since they interact through activities with the learning material for knowledge construction. The active characteristics may be referred to empowerment, student-centered, self-authorship and participatory education. This *active learning-centered* approach focuses on students' experiences as a context for constructing knowledge in contrast to the *teaching-centered* approach that focuses on knowledge acquisition and control [Magolda, 1999]. Instead of emphasizing lecturing and telling by instructors, we encourage the students to engage actively in establishing and pursuing their own learning objectives. The American Psychological Association (APA)³ suggests a guideline of learner-centered principles to be developed and incorporated into the components of new designs for schooling. Yet, we have seen that it can be apt to higher education context.

According to psychological framework by Learner-Centered Work Group of the APA's Board of Education Affairs,

"These principles emphasize the active and reflective nature of learning and learners. From this perspective, educational practice will be most likely to improve when the educational system is redesigned with the primary focus on the learner. [APA, 1997]"

In this chapter, we have explored and presented the interplay between these theoretical frameworks. We also explored educational theories in order to blend them in our research. In the next chapter, we investigate the technological environment in education through the combination of the theoretical frameworks presented in this chapter; namely, *constructivism*, *constructionism* and *learning webs*.

³ The American Psychological Association (APA): <http://www.apa.org/>

Later on, we attach these principles into our research field and give explanation in chapter 4 Higher Education.

As we would like to deploy computer tools into the learning environment, the next chapter explains the role of technology in education in detail. Moreover, we provide a survey of available technologies, which are, state-of-the-art. Some tools are popular among students, especially social software tools. Students have been using them not only in daily life, but also for their classroom learning. Based on social network software, we analyzed the relationships and flows among people, groups, organizations, computers, and other information processing entities. We see a possible way to deploy these tools into the higher education context. Effective learning in higher education shares the framework of this chapter 2. Though, the academic structure of university is well organized regarding syllabus and curriculum, we should offer a challenging learning environment where encourages student to be more interactive and less passive for their studying.

In chapter 4 we present what constitutes practical teaching and learning in higher education. It is not easy, especially to employ a loosely controlled environment or even less forced environment in order to gain more interaction and participation from all the participants – teachers, tutors and students. Thus, our innovative attempt is to bring Constructionist Learning into the higher education context. We explore the way to embed the aforementioned perspectives into the classroom learning and present how to apply such frameworks to action in chapter 5 and 6.

3. TECHNOLOGY IN EDUCATION

Chapter 2 went in length educational theories and the contemporary learning framework enclosed with various technologies. In this chapter, we will explore more details on the influences and roles of technology in education. Later, we describe the investigation of the pedagogical meanings and perspectives on constructionist tools. We also explore the design aspect of the convivial learning environment and examine the impact of technologies on social context. This chapter starts with a discussion on the evolution of technology in education, followed by a presentation of previous efforts in using computers in education. This is crucial to envision the digital learning environment that may be suitable to requirements and behaviours of today's learners. We observe that the recent evolution of technology, such as Web 2.0 and Social Networking Software, may be applicable in creating an effective learning environment as convivial tools for students, in particular.

3.1. Evolution of Technology in Education⁴

What influences have digital media had on education? The evolution of technology and efforts to integrate computers into various curriculum models over the past several decades could be the answer.

In the 1950s, emerging computers for education were merely teaching machines, as some learning technologists believed that technology made the teacher out of date [Skinner, 1968]. In the next decade, we witnessed the development of educational software based on behaviourist. In early 1970s, emerging were well-known educational

⁴ Part of this section has ever been published in "The Nation" newspaper. Pusawiro, P., CHALK TALK: Computers in the classroom. The Nation. 8 February 2010, 15A. Also available from: <http://www.nationmultimedia.com/home/2010/02/08/national/Computers-in-the-classroom-30122013.html>

systems such as Computer Assisted Instruction (CAI) and Intelligent Tutoring Systems (ITS). An instructional technology, CAI serves as a new learning paradigm for courseware building tools, designed for a process of transmission and delivery of content specifically for instructional purposes. CAI was designed to empower instructors, not learners, and it was not quite successful. Researchers reported that the impact of computers on instructional practices was minimal and that technological influences in education fields, such CAI and ITS, were not successful [Reiser, 2001, 60]. So far, such systems have still been used for cognitive and collaborative learning purposes in education [Jonassen et al., 1999] [White et al., 2000] [Jonassen and Carr, 2000].

At the same time, a few artificial intelligence researchers started working in education, developing automated tutoring systems and other applications [Bobrow and Collins, 1975] [Sleeman and Brown, 1982] [Wenger, 1987]. Then, in the 1980s, scientists like Papert and Schank made widely popularized claims that the computer would radically transform schools [Papert, 1980] [Schank, 2006].

Since the 1990s, the Internet has become a major driving force in the integration of computers and related networks into schooling. All affordable educational institutes have bought computers and installed educational software for their classrooms. Web-Based Instruction (WBI) has since been introduced [Sugrue, 2000]. WBI has also extended to Web-Based Learning (WBL). Sugrue additionally explained four instructional elements performing a cognitive function of WBL process that embodies into four instructional strategies: information organization and access, authentic activities, collaborative learning, and student modelling. Most schools and universities used computers with installed educational software for their classroom [Cuban, 2001]. Today, digital media technologies have become an integral part of the learning environment. ICT has become a common tool in classrooms and an abundant source of new learning materials to aid learning with technology and to provide new learning experiences.

There are widely adopted communication tools to facilitate interaction among learners via email, computer conferencing, and online forums to support functions of conversation and collaboration in the classroom. Various tools including social software are widely available, helping computers become an integrated part of teaching and learning applications in order to create a more authentic learning environment with meaningful learning in a social context. Multimedia and visualization help students interpret and represent ideas visually and holistically. It also engages learners in the use of more creative thinking skills. Computers also facilitate a powerful method of delivering information. Currently, millions of students know how to use word processors, spreadsheets, design webs, search engines, and digital libraries as part of their study.

3.1.1. From Instruction to Active Learning

Reacting to the rapid development of multimedia and hypermedia in the 1980s and early 1990s is the emphasis on project-based learning. A tendency for technology-based practice to support traditional instructionist approach was evident, where information transmission from teachers to learners was the main focus. It is a form of rote learning and frontal teaching.

For decades, computer use was not promoted for learning purposes; instead, they were used as quick add-ons to the existing instructional and traditional classroom [Cuban, 2001]. Nowadays, educational institutions are connected to the Internet, and it is a tool for instruction, as in WBI and WBL, and also for self-paced and lifelong learning. As noted earlier, computer services centers also had a goal to support the effective use of computers and augment ICT in classroom learning. This effort initiated the implementation of technology into educational institutions in hope to make students more proactive in their learning.

Regarding technology supported education [Barker, 2004], computers are used as tools and medium in teaching and learning. This paper addresses the use of technology to enhance learning, rather than learning to use technology. To make technology more useful in classroom learning, it is important for both students and teachers to understand the concepts behind that technology-based approach. The emergence of current technology has a potential to reform and revolutionize the educational system. It creates a widespread integration of technology into the classroom curriculum. At this point computers can be helpful in providing an alternative learning environment in which students can access the course ubiquitously, namely anywhere and anytime.

Both learning and teaching involve motivation as it influences both learners and teachers. Realizing this, most universities spend the first week training students on how to use the campus platform such as Learning Management System (LMS) and Learning Content Management System (LCMS).

The platform could be used successfully when we understand the aforementioned ICT evolution and the relation between technology and educational theories. Computer technology has, for decades, been applied to various areas of learning. In the educational context, it has resulted in a significant change in perspectives on teaching and learning.

Some Schools of Education and Learning Sciences have started researching the integration of technologies and its impact on learning. Learning scientists noted that computers could play a powerful role in transforming all of learning. Some researchers rejected the instructionism and behaviourism of using CAI system as effective for learning [Kovalchick and Dawson, 2004] [Adelsberger et al., 2002]. They believe in a new vision of the role of computers in schools, while oppose the traditional use of instructionist software. They argue that since educational software has been based on instructionist theories, the computers performing such roles are similar to the teacher performing such traditional roles. The CAI software is merely a form of one-way, passive learning. Whereas, progressive learning scientists have suggested that computers should be used to facilitate roles and help students experience deep learning by, for example, helping them to collaborate or to reflect on their own learning in order to develop knowledge. It is a form of active learning along the same lines as constructionist learning.

In this thesis, we foresee a new model of technology in education in which the next generation of educational software is carefully designed via a close collaboration between the instructors and the university's computer service center. To effectively use technology in education, we not only use educational technology to help students perform a given curriculum better or faster, but we also use technological knowledge as a facilitator and way of accessing broad areas of learning and thinking by means of the

constructionist process. In doing so, one needs to understand the usage behaviour of this digital era's net-generation students. In the next section we examine the impact of technologies and the roles of technological learning tools in education. Consequently, we analyze the design concept of computational tools, and then correlate that design to Illich's ideas of "Tools for Conviviality" [Illich, 1973] in section 3.4.

3.2. Technological Learning Tools in Education

Educational technology researchers have found that computers are used as part of classroom reform and they have most impact in classroom process. Technology, explicitly computer software, is central in the learning process because the visual and processing power of current personal or network computers supports profound learning. To understand the roles of technology in education, there is an attempt from several research labs, for example, the Stanford Center for Innovations in Learning (SCIL)⁵, the Future of Learning Group⁶ and Tech & Learning Group⁷, where study keenly regarding education and technology.

In this section, we explored and review the impact of computer in learning from various researches.⁸

⁵ The Stanford Center for Innovations in Learning (SCIL): <http://scil.stanford.edu/>

⁶ The Future of Learning Group: <http://learning.media.mit.edu/>

⁷ Tech & Learning: <http://www.techlearning.com/>

⁸ The section 3.2.1 and 3.2.2 have been reviewed and excerpted the journal from *The Future of Children: CHILDREN AND COMPUTER TECHNOLOGY* Vol. 10, No. 2 – Fall/Winter 2000. Also available from: http://halshs.archives-ouvertes.fr/docs/00/19/06/10/PDF/A103_Roschelle_etal_01_Packard.pdf

Emphasize on the powerful role of computers in transforming all learning, learning scientists did not totally agree on using CAI systems due to their instructionism and behaviourism aspects. Indeed, they saw a new vision of computers in schools. For example, Sawyer blended technology scenarios that focus on deep and higher-order learning based on the following insightful evidences [Sawyer, 2006]:

- Computers can represent abstract knowledge in a concrete form
- Computer tools can articulate their developing knowledge of student
- Computers can support simultaneous articulation, reflection, and learning
- Computers can support reflection in a combination of visual and verbal modes
- Computers can support to share and combine their developing understandings

3.2.1. Changing Factors for Effective Learning

Regarding the development of ICT in education, various tools are available such as expert systems, learning agents, simulations, office support tools, graphic tools, CAI, WBI, LMS, LCMS, Portal, and Social Network. It is worth exploring how learning takes place via the use of digital media, Internet technologies, and networking tools.

Concerning learning with technology, nonetheless, it is accepted that technology can have a great impact in improving teaching and learning [Phillips, 2001] [Coppola, 2004]. Also *Children and Computer Technology* reported the very interesting findings as follows:

"[Computer-based] technology is only one element in what must be a coordinated approach to improving curriculum, pedagogy, assessment, teacher development, and other aspects of school structure, ... so the gains in learning cannot be attributed to use of technology alone. [Roschelle et al., 2000, 78]"

We have seen that computers can empower and ensure deep learning when implemented the right way. Today, digital technology is a powerful tool that has already transformed the practices of learning. Hardware and software availability vary from classroom to classroom. There is an even greater variation in the way classrooms use technology, tools like pens, pencils, chalkboard, plain paper, transparency and so on can be an instructional tools in the past, while digital media technology has become the new generation of tools. Examples include digital videos, online courses, simulations, games, augment reality, virtual environments, wikis, blogs, podcasts, student response systems, web conferencing, virtual characters, online communities of practice, RSS feeds, mobile learning and so on [Richardson, 2009].

In truth, the studies in the effectiveness of technology suggested that certain computer-based applications could enhance learning at various achievements level. This highlighted several promising applications that technologies not only help students better learn, but also help them learn better things [Luckin et al, 2009].

3.2.2. Technology Enhanced Learning: Passive and Active Roles

Learning scientists have suggested providing students an active role in solving problems. This may empower learners to communicate effectively when analyzing information and designing their own learning. In the *Enhancing How Children Learn* section, the researchers explained that:

“Some of the pioneers in learning research also have been pioneers in exploring how technologies can improve learning. ... They have realized that the structure and resources of traditional classrooms often provide quite poor support for learning, whereas technology—when used effectively—can enable ways of teaching that are much better matched to how [students] learn. [Roschelle et al., 2000, 79]”

According to *How people learn: Brain, mind, experience* book and *Handbook of educational psychology* the researchers suggested that we should bring together experiences, interpretation, and structured interactions with peers and teachers in order to promote actively constructing knowledge and learning through active engagement. Moreover, researchers found that technology may support the mental processes of thinking, perceiving, and remembering, according to Bransford and team [as cited in *ibid.*]. Students possess different learning styles and learning theories are different in some details, as presented in Chapter 2. We agree with educational reformers that in order “to enhance learning, more attention should be given to actively engaging [students] in the learning process” [*ibid.*], such concept joined in line with constructionist learning as said below:

“Cognitive research has shown that learning is most effective when four fundamental characteristics are present: (1) active engagement, (2) participation in groups, (3) frequent interaction and feedback, and (4) connections to real-world contexts. [ibid.]”

To engage actively in learning, students should not put into the passive role or just situate in the transmission model of learning, otherwise they might not be trained to apply what they competent to understand outside-classroom-learning, according to Bransford and Schwartz [as cited in *ibid.*].

With reference to constructionism, project-based and experience-based learning can certainly actively engage students, with or without a computer. As confirmed from the findings and evidences of classroom lab:

“Although active, constructive learning can be integrated in classrooms with or without computers, the characteristics of computer-based technologies make them a particularly useful tool for this type of learning. [ibid.]”

Evidences showed actively engaged students witness the improvement in their understanding and knowledge in the subject matter, as well as self-confidence. To enhance learning, researcher suggested connecting the fundamental characteristics of learning. Likewise, Gardner suggested to combine more methods beyond lectures and books that may reach students who learn best from one or more other teaching approaches, since students have different, multiple learning styles [as cited in *ibid.*].

Learning Network and Connected Participation

In accordance to constructionist learning, technological tools should possess the 4 characteristics of a learning network: participation, interaction, feedback, and connection. In relation to the social context, a social network and collaborative learning enhance participation in groups as said:

“Performing a task with others provides an opportunity not only to imitate what others are doing, but also to discuss the task and make thinking visible. ... Through informal social conversation and gestures, students and teachers can provide explicit advice, resolve misunderstandings, and ensure mistakes are corrected. [Roschelle et al., 2000, 80]”

Such a social environment can encourage student learning through their active participation. To motivate participants of group learning, social need is a driving force to such learning. In addition, Lave and Wenger suggested about communities of practice in his *Legitimate Peripheral Participation* article:

“Because a child's social identity is enhanced by participating in a community or by becoming a member of a group, involving students in a social intellectual activity can be a powerful motivator and can lead to better learning than relying on individual desk work. [as cited in ibid.]”

Computer may sometimes isolate students and engage students individually, but it is crucial to promote using technology in a collaborative way regarding the analysis of distributed multimedia learning environments:

“[Collaborative activities] can enhance the degree to which classrooms are socially active and productive and can encourage classroom conversations that expand students' understanding of the subject. [as cited in ibid.]”

According to Riel and Weir, they analyzed on educational telecomputing and electronic communities of learners, respectively, and suggested that

“[Students] who participate in computer-connected learning networks show increased motivation, a deeper understanding of concepts, and an increased willingness to tackle difficult questions. [as cited in ibid., 81]”

Consequently, this is participation in groups. In connection to network of expertise, above and below perspectives are similar in concept to “Learning Webs”, as mentioned in Chapter 2. To connect learning to the real-world contexts, researchers said as follows:

“Computer technology can provide students with an excellent tool for applying concepts in a variety of contexts. ... technology can bring unprecedented opportunities for students to actively participate in the kind of experimentation, design, and reflection that professionals routinely do, with access to the same tools professionals use. Through the Internet, students from around the world can work as partners to scientists, business-people, and policymakers who are making valuable contributions to society. [ibid., 82-83]”

Learning Through Interaction and Feedback

Pimm researched about communication in mathematics classrooms that “in traditional classrooms, students typically have very little time to interact with materials” [as cited in *ibid.*, 81] or among their peers. Furthermore Anderson pointed out in *the architecture of cognition* that:

*“In contrast, research suggests that learning proceeds most rapidly when learners have frequent opportunities to apply the ideas they are learning and when feedback on the success or failure of an idea comes almost immediately. [as cited in *ibid.*.]”*

As seen through the viewpoint of constructionist philosophy, a similar action to interaction and feedback is trial and error. Schofield studied computers and classroom culture and found that:

*“Unlike other media, computer technology supports this learning principle in at least three ways. First, computer tools themselves can encourage rapid interaction and feedback. ... Second, computer tools can engage students for extended periods on their own or in small groups. ... Third, in some situations, computer tools [such as e-Portfolio and blogs] can be used to analyze each child's performance and provide more timely and targeted feedback than the student typically receives. [as cited in *ibid.*.]”*

Connected Learning to Real-World Contexts

According to the book *How people learn: Brain, mind, experience and school* a vast literature on learning through connections to real-world contexts suggests that:

*“[To] develop the ability to transfer knowledge from the classroom to the real world, learners must master underlying concepts, not simply memorize facts and solution techniques in simplified or artificial contexts. [as cited in *ibid.*, 82]”*

Most researchers rarely implemented such real-world contexts via project-based learning or the participatory design concept as reported that:

*“[Simply] installing computers and Internet access in schools will not be sufficient [to deploy technology in the education context]. [as cited in *ibid.*, 90]”*

A combination of effective technology tools with new instructional approaches and new organizational structures will yield greater success. Instructors should be supported in the pedagogical use of technology, specifically the classroom guideline and feedback process in class. It is need a teacher support as Shulman proclaimed in *Knowledge and teaching foundations of the new reform* that:

*“Effective use of computers in the classroom requires increased opportunities for teachers to learn how to use the technology. Studies show that a teacher's ability to help students depends on a mastery of the structure of the knowledge in the domain to be taught. [as cited in *ibid.*.]”*

For example [*How people learn: Brain, mind, experience and school*]:

“Technology itself, however, is proving to be a powerful tool in helping teachers [set up an effective teaching strategy in the classroom]. [as cited in ibid.]”

In *Technology’s role in education reform: Findings from a national study of innovating schools*, Means and Olson identified several key factors associated with the effective use of technology in classrooms as follows:

“Technology access and technical support; Instructional vision and a rationale linking the vision to technology use; Critical mass of teachers in technology activities; High degree of collaboration among teachers; Strong leaders; and Support for teacher time for planning, collaboration, and reporting technology use. [as cited in ibid., 92]”

The challenge is to ensure the effective use of technology to enhance how and what students learn. Thus, the survey journal concluded:

“Using technology to improve education is not a simple matter. There are many kinds of technology and many ways that an attempted use can fail. [ibid.]”

It would be desirable to have an understanding and broadly generalized knowledge of each candidate technology. So, it is implied that to improve how and what student learn, it needs to explore further on the effective use of technology.

3.2.3. Learning Network: Constructionist, Reflective and Active Tools

Needed now is a new model for learning environments that can take benefit from the pervasive availability of computational tools and of the properties of accessibility to computing and internetworking technologies. For instance, the ubiquitous computing capability combines computers with networks and high bandwidth connectivity. Ubiquitous computing may be a key technological foundation to the fundamental change in education.

The emerging web-based social media can also broadcast knowledge and information through online social interactions. It can transform learners from content consumers to content producers, while creating a new word such as personal media out of the mainstream mass media.

Nowadays students can be content creators discussing their personal interests in any subject via social media. They interactively create their own contents such as words, pictures, videos and audio, and then share them via the Internet.

While mass media works passively, personal media is interactive and widely available through technology and online social interaction. Learners can create their own stories. For social and personal media, we must consider emerging technology such as Cloud Computing and Web 2.0, considered to be state-of-the-art technology for social networking software.

Computer networks, like the World Wide Web (www), may provide a new interactive structure and style of learning to support learners in a shared context. The web enables access to a huge set of resources. The learning environment provides tools for learning. In order to use them powerfully, learners have to associate the use of information technology and the understanding of their learning.

Regarding human behaviour and culture, some of socioculturalists work along these lines, for example, Cole, Lave, Rogoff and Saxe, focused on informal learning and observed behaviour with a complex surroundings, as declared:

“[A] human created environment filled with tools and machines, but also a deeply social environment with collaborators and partners.... This research revealed that outside of formal schooling, almost all learning occurs in a complex social environment, and learning is hard to understand if one thinks of it as a mental process occurring within the head of an isolated learner. [as cite in Sawyer, 2006, 9]”

This approach has been widely influential in collaborative learning, teamwork and group dynamics in classroom like CSCL⁹ and BSCW¹⁰. We also agree that the learning skills and strategies for learning can be supported and enhanced by computer networks [Jonassen and Carr, 2000] [Harper et al., 2000]. Through this channel, they can contact experts, send answers and get feedback. Learning is this enhanced via the network. Undeniably, this is similar to the idea of Illich's educational webs.

⁹ International Journal of Computer-Supported Collaborative Learning (CSCL): <http://ijcscl.org/>

¹⁰ Basic Support for Collaborative Work: <http://www.bscw.de/>

In short, we have seen that social networking software can enhance the traditional learning models with the support of the constructionist principles mentioned in Chapter 2. This apparition of sharing and learning with the expert was formerly suggested by the learning web's vision of Illich as explained in section 2.4. To be examined in the next section is the particular social-technology-rich issue. A trend analysis and state-of-the-art social software analysis is presented in section 3.6.

3.2.4. Interactive Learning Environment: Social Activity

In section 2.2, we presented the social context of constructivism. The influence of activity theory has led the researcher in a new thinking about pedagogy and the learning process. Researchers are beginning to determine how activity theory can influence the design of learning environments [Jonassen, 2000]. Activity theory focuses not on individual learners, but all as a social unit. A well-known example is of students on a networked learning course collaborating on a project via an activity system [Cole and Engenström, 1993]. The fundamental relationship between the individual participant and the activity system's purpose is not direct, but is mediated by tools. Participants are usually part of communities, a relationship mediated by discourses and interactions. Activity systems are in constant development, always changing through the action of new participants, purposes, and tools. Tools make activity possible in the first place. Tools can be both physical such as networks, books and software; and cognitive such as concepts, language and memory. Tools both enable and constrain activity through their affordances.

There are several works providing a set of guiding principles to help learners and teachers create learner-centered and authentic environments that support students' reflective thinking [Hung and Chen, 2001]. The idea behind these studies in creating helpful learning environment is to change the meaning and value of computers to an interactive tool with which students can manage their own learning and meaning in more constructionist and collaborative way. For example, at higher education level, the *University of Houston at College of Architecture* designed pedagogical process on collaborative learning and announced using collaborative learning philosophy for a degree in industrial design, as explained on the website:

"Collaborative learning is defined as a learning process that emphasizes cooperative efforts between instructors and students. Collaborative learning is an important cognitive strategy based on the social construction of knowledge, which leads to deeper processing and understanding than learning without collaboration. [University of Houston, 2010]"

Undeniably, using technology is the important in learning and teaching process at university level. As supported by the Internet, collaborative learning can provide a new approach to integrating social, cultural and practical issue into learning. The communication capabilities of the network make it easier than ever before to support collaborative learning environments.

A technology-rich learning environment is one of the key factors needed in effectively using ICT in education. As based on Vygotsky, in the activity theory mentioned in Chapter 2, learning and teaching can be viewed at each of the 3 levels of an activity system: activity, action, or operation. Then, the learning platform can be seen as both a convivial tool (more in section 3.4) and as a simulated activity system within which

students, as participants, are able to interact and communicate each other. Several issues in participating and learning should be noticed. The quality and the legitimacy of participation define the ways of belonging to the communities of learners [Lave and Wenger, 1991]. This is not only a crucial condition of learning, but also a constitutive element of the interest in content. To belong is to be an on-going engagement into communities as socially desirable.

Lave and Wenger emphasized the need to learn to achieve a desired form of participation in a wider community. The essence of a community of practice occurred through engagement in some activity and aggregation of the learner. These manners come to develop and share practices when selecting the digital learning environment. To ensure that the students learn something useful via technological tools, the teachers should develop a proper plan to sustain their learning.

There is no specific theory that can fully match the classroom process. Several learning concepts should be forged together in order to make ICT, a crucial tool in the implementation of this new learning model, and well-suited for the class. Both digital technology and constructionist learning can provide a conceptual framework for co-constructing learning environments.

Emerging context of technology in education can be summarized and characterized as accessible, flexible, virtual, ubiquitous, mobile, connected, collaborative, authentic, interactive, and learner-centered. This provides a more dynamic and affordable learning environment for today's digital era. In the next section we review research work that created a learning environment and employed constructionist approaches in the design and development of educational tools.

3.3. Tools in Constructionism

As mentioned in section 2.3 that Papert invented the term of constructionism based on Piaget and his own learning experience. Later, he worked at the Artificial Intelligence (AI) Lab, MIT and created a programming tool that aim to enhance children in learning mathematics. Not only educational research explored the constructionist theory, but also Artificial Intelligence and Expert Systems field, as to the following summary about constructionist philosophy:

"Constructionism is a theory of learning and a strategy for education. Constructionism is based on two different senses of construction. [1] People learn by actively constructing new knowledge, not by having information "poured" into their heads. [2] People learn with particular effectiveness when they are engaged in "constructing" personally meaningful artifacts (such as computer programs, animations, or robots). [Brown, 1998]"

In this section we revisit the constructionist thought through the eyes of information science researcher, while covering constructionist tools in greater depth. According to [Papert, 1980], he saw the potential of a computer as a powerful tool to fundamentally transform the way people think, work, learn, and communicate. Children can learn to use computers in a masterful way. Such learning, through using computers and technology, can change the way children learn everything else, particularly through more socialization and greater interaction in a classroom.

3.3.1. Constructionist Research: Powerful Computer Tools

Papert was trained as a mathematician. According to *Education and Artificial Intelligence* article [Brown, 1998], it assembled the interesting work of Papert and summarized the implementation of constructionist philosophy and technological tools that his focus was on cognitive development when he worked with Piaget in Geneva. From 1958 to 1963, he first began his work of using mathematics to model and understand how children think and learn. Later, Papert worked at the Artificial Intelligence (AI) Laboratory and the Media Laboratory at Massachusetts Institute of Technology (MIT). Then, he created a simpler form of LISP called LOGO philosophically constructed to allow children to program turtles to draw intricate geometrical figures, according to Brown's report.

Papert broadly defined an AI perspective on learning as a cognitive science that may form a concrete to abstract thinking idea. It is a form of meta-thinking or "thinking about thinking" [Papert, 1980, 19]. Papert's study gives psychologists a new vision on thinking. Papert suggested that to associate learning by giving the individual a liberating sense of the possibilities of doing a variety of things that may have previously seemed "too hard" for young children [Papert, 1980, 47]. Children were encouraged think more concretely about mental processes:

"While psychologists use ideas from AI to build formal, scientific theories about mental processes, children use the same ideas in a more informal and personal way to think about themselves [Papert, 1980, 158]"

Similarly, Papert studied computational models to better understand the developmental process. To make such a model dynamic and relevant to education, Papert advocated the use technology or computer as a change agent for education as excerpted.

"[When] Piaget talked about the developing child, he was really talking about the development of knowledge. ... Children were held back in their

education, Papert claimed, because they had a model of learning in which there was a right way and a wrong way to do something. [as cited in Brown, 1998]"

Actually, people seldom get anything exactly right on the first try, but usually go through a trial and error experimental process. Similarly, when programming a computer, the programmer almost never gets it right the first time, but "the question to ask about the program is not whether it is right or wrong, but if it is fixable" [as cited in *ibid.*] via "debugging" strategies. If this way of looking at computer programming products were generalized, Papert proposed, learners might be less intimidated by our fear of "being wrong", but might try and fix it.

The foremost work of constructionist research is from the Future of Learning Group of MIT Media Laboratory that explored how new technologies can enable new ways of thinking, learning, and designing.¹¹ The researchers there were dedicated to the multidisciplinary study, invention, and the creative use of enabling technologies to enhance learning.

"Papert said that the computer was a more powerful tool for intellectual development than other new technologies because it put the learner in a new relationship to a domain of knowledge, more active and self-directed. [as cited in Brown, 1998]"

Papert's renown tool, the LOGO programming language, represented an environment in which students can explore and test their ideas as they create science simulations, mathematical experiments, interactive multimedia stories, or whatever they can imagine [LCSI, 2008]. For example:

¹¹ The Future of Learning Group, MIT Media Laboratory: <http://learning.media.mit.edu/>

“When children used the programming language LOGO to program turtles, they were basically teaching the computer to think. To accomplish this, they have to think about thinking themselves. ... The computer solves problems in such a way that the abstract and hard to grasp becomes concrete and transparent. [as cited in Brown, 1998]”

Other samples of constructionist learning environment research are Multi-User Dungeons (MUDs) and MOO (Object-Oriented MUD). Both MUDs and MOOs use networking technologies to form an Internet-based multi-user environment. Multi-User Dungeons (MUDs) was previously a multi-player Dungeons and Dragons game played over the Internet. Similar to MUD, Bruckman designed and created a text-based virtual world for children called MOOSE Croosing [Bruckman, 1997]. The goal was to create a virtual space where children engage each other in a peer-supported form of learning and to examine how the Internet context could serve as a space for collaborative community learning. Ultimately, the goal is to give learners more flexibility in how they represent their ideas to others. In particular, it facilitates the dialogues process within a community. Originally derived from the online Dungeons and Dragon environment, MUD provides an authentic learning environment for students to enter and actively participate. With respect to the emergence of virtual reality and multimedia technology, some MUDs and MOOs offer alternative means of accessing information through experiential learning via the virtual learning environment or virtual world. There has been some research on the use of MUDs for education, focusing on the principle of constructionist learning [Bruckman, 1997].

Another example is the distributed constructionist tool so-called StarLogo: “specialized version of Logo that allows one to control thousands of graphic turtles in parallel” [Resnick, 1999]. Resnick worked with Papert in developing constructionist tools that help children learn new things via new toys, as called constructionist kits. Moreover, with StarLogo, a user can model and gain insights into many real-life phenomena, such as bird flocks, traffic jams, colonies, and market economies, as explained by [Resnick, 1999]. These groups of artifacts have no leader and are not organized, but yet have the ability to move in concert.

Examples include the programmable bricks developed and designed based on LEGO LEGO, the red box project that engages children in scientific and new computational tools by playing with programmable beads [Resnick, 1997]. Later, this programmable brick was developed to LEGO Mindstorms. That version of the LEGO Mindstorms and its current version called NEXT are commercial products that integrated LEGO and LOGO, robotics and engineering, and motors and computers into the Robotic Invention System [LEGO, 2008].

Another constructionist tool is Constructopedia [Papert and Resnick, 1995]. The idea behind Constructopedia is to develop a searchable, interactive database that assists children in working on design projects and making connections to the math and scientific ideas underlying those projects. The how-to information contains examples, explanations and visuals related to that entry’s topic. Only few have paid attention to features in the development and deployment of the constructionist approach for higher education, though. Among the few is Martin whose dissertation worked and experimented with engineering students at the Massachusetts Institute of Technology [Martin, 1994]. He used programmable brick as a constructionist tool for learning robotics in a mechanical engineering course.

To sum up, constructionist tools can provide knowledge access to students, not only instrumentally by providing them with processed information, but also by challenging some constraining assumptions they may make about themselves. Students, through computer models, can also mould abstract ideas previously seemingly intangible to them into concrete areas of knowledge. This skill is related to internalization and externalization processes explained earlier in Chapter 2.

3.3.2. Object-to-think-with: Constructionist Tools

Tracking back to the original idea of Constructionism, Papert, through the use of LOGO to program a turtle, believed children could be taught to think more concretely about their own mental processes. It said, "When a child learns to program, the process of learning is transformed. It becomes more active and self-directed" [Papert, 1980, 21]. Thus programming via a computer can "give concrete form to areas of knowledge that had previously appeared so intangible and abstract" [ibid., 23]. This is a model of using the computer as an "object-to-think-with" [ibid., 23].

The design concept of constructionist tools always focus on objects, its function, and its meaning. Such objects are a very rich material and instrument to work with. Inspired by this, the construction of learning environment engages learners in the design of personal, meaningful objects. These objects not only have a decorative function but they also support the learners in sharing their personal meaningful object when used to support their own learning. This explicitly associates their daily life with their personal learning.

In education, there was some lessons show the potential of using object-to-think-with as an artifact for meaningful learning. For example, the work of Montessori and Fröbel designed a number of manipulative objects, materials, props, toys and gifts to help children develop a deeper understanding of mathematical concepts such as numbers, size, and shape [Montessori, 2008] [Fröbel, 2008]. In the same spirit concerning digital technologies, the digital manipulative seeks to expand the range of concepts that children can explore, particularly dynamic processes, by embedding computational power in traditional children's toys such as blocks, beads, and balls [Resnick, 1996b].

The mainstream education system addresses a printing media as an object for teaching and learning. However, exploring new media such as digital media and social media can change a child's relationship with knowledge, as well as to the present education system.

In *The Children's Machine* book, Papert made an analogy between digital media and literacy or the ability to read. Becoming literate, he asserted, means thinking differently than one did previously, seeing the world differently, suggesting a much different type of literacy. Papert distinguished *literacy* and *letteracy* in order to reflect the use of the media for transmitting information and ideas.

"Letteracy refers to a very special knowledge about letters as distinct from the richer knowledge, which is what we really care about. These two meanings are evident when people talk about computer literacy; by computer literacy they mean that one knows a little bit about computers and yet if somebody knows just that little about books, one would say that they were illiterate. [Papert, 1993, 10-11]"

Constructionist tool kits help implement education reform and give a chance to children to explore the world via technologies. Similarly, in Project Lighthouse, we adopted “technological fluency” [Papert and Resnick, 1995]. It conveyed “the ability to use technology fluently, in the way that one is fluent with language so as to express thoughts, create artifacts, communicate with others, and realize ideas” [Cavallo, 1999, 135]. However, we have rarely seen such example in the higher education, this thesis will explore and seed this idea in the experiment section (See Chapter 5 and 6).

In summary, this thesis examines the potential of using technology as an object-to-think-with or artifact to help students think and learn in a new way through the digital and social software media. The co-construction makes an explicit decision about which computing social tools, as objects would become part of their learning environment in order to make learners engage in introspection and reflection.

3.3.3. Learning by Doing and Making: The Constructionist Process

In reference to the very powerful concept of learning by doing, we learn best by the special kind of act that consists of constructing something outside of ourselves. A child building a tower, writing a story, constructing a working robotic device, or making a video game are all examples of constructing. All these activities have several features in common; i.e., they are subject to the test of reality where if fail work they must be carefully studied and understood in order to overcome the obstacles. Through these practices, they can be shown, shared, and discussed with other people [Papert, 2008].

In a world where information and knowledge changes rapidly, developing the ability to learn and apply this learning in dynamic domains is fundamental and critical. Papert divides the “theory of knowledge” from “the method of teaching”, and then proposes the concept of “knowledge-in-use” [Papert, 1993, 63]. According to the LOGO philosophy, Papert believed that children of all ages and from all social backgrounds could do much more than believed by adults. Just give them the tools and the opportunity that they can explore knowledge-in-use: “Opportunity means more than just access to computers. It means an intellectual culture” that can facilitate with powerful ideas [Papert, 1999b] [Papert, 2008].

Unfortunately, there is a great deal of talk about putting more control in the hands of the students and turning teachers to facilitators. However, computers in school are generally used to support the traditional role of teaching [Papert, 1999b]. In *The Children's Machine* book, Papert gives several examples of children who, sometimes for the first time ever, are beginning to really learn, because of being allowed to do so in an experiential way. They learn to “feel their way” towards a goal. This goal is allowed to evolve, with much experimentation along the way. Papert used the coined term, “bricolage” which is French for “tinkering” [Papert, 1993, 131]. In other words, both bricolage and tinkering are the ability to make things with whatever is at hand, and the ability to think outside the box when it comes to using the items.

Another lesson learned is Project Lighthouse; a constructionist pilot project held in Thailand, as reported:

"Constructionism proved to be an idea that people could grasp and use as a basis for guiding activities. Often people know what they do not like about existing learning environments, but do not have any practical concrete principles on which to base action. [Cavallo, 1999, 134]"

The mission of the project was to make the learning of all subjects more personal and more meaningful to the learners, so that learning is better motivated and far more effective through the inclusion of the study of computer and other technologies. The project experimented on:

"[How] computer technology can be used to create conditions for radically new ways of learning characterized by giving students greater control over the learning process with the result that they learn to take charge of their own learning. [ibid., 133]"

The result found computer technology to be important on two facades: (1) aiding discussion, reflection, and brainstorming about the issues, and (2) designing and implementing the actions, according to Cavallo [ibid.].

To reinforce constructionist activities, learners engage in constructing artifacts, solving problems via project-based learning and then reflecting their work visibly. These activities promote a process of externalization and internalization of the learners' ideas, which is based on their interaction with the physical object and the environment – "in the head" to "in the world" [Papert, 1993, 142]. Externalization of ideas has proven to be a preferred process in a learning environment that promotes learners' imagination and creativity. During project activities, students work and share ideas collaboratively and collectively (See Chapter 5). It is learning by doing and making through personally meaningful and energetic artifacts.

Papert suggested when exploring new ways of thinking different from the school's way of thinking, we should find the direction within ourselves; this "human experience" will give us a vaster store of knowledge than all of that developed by academics in laboratories [Papert, 1993, 21]. That direction plays an important role in the development of friendliness or conviviality in the learning environment. In this thesis, we cultivate a constructionist process into the convivial environment (See section 3.4) to explore how learners facilitate their joyful learning with their own experience and selected tools. We study how students interact with their peers in a learning community and how we can implement externalization and internalization with our own experience via the learning by doing-making process.

For that reason, in designing our case studies (See Chapter 5), we used the project-based learning model. Students gained more fluency with the tools used to share and implement their desired learning tools. The use of tools created an interaction within their community. In Chapter 5, we show that tools construction also benefited students in the learning-by-doing process because it provided an environment to share an objects-to-think-with via the feedback and dialogue process in both the learning platform and in the classroom. In short, the core activity of our work was to construct meaningful artifacts by means of project-based learning and the constructionist process.

3.3.4. Powerful Ideas: Constructionist Learning Environment¹²

Technology, specifically computers, can also play an important role to enhance powerful ideas. Through constructionist learning environment, students may explore, externalize and share powerful concepts and new ways of thinking. Technological tools construct digital media. They can also help students toy with their ideas in both a formal and concrete way, as in our examples in the previous section.

The use of technology in education does not only involve using computational objects to help students perform a given curriculum better or faster, but also involves using technological knowledge as a facilitator in order to access broad areas of learning, doing, and making. Technological fluency can further open the gateway of expression and collaboration via shareable, computational, dynamic, and interactive environments. At the same time, the co-construction learning environment facilitates broad and deep development of technological fluency.

The current boom of social software tools fosters the technology fluency. Students live in a technologically rich culture where there is in-depth knowledge, familiarity, and passion about building and applying technology to accomplish personal, group, or social goals.

According to constructionist researchers, computers can play three different roles on powerful ideas [Papert and Resnick, 1995]. They can be neutral, liberators, or incubators of powerful ideas. The neutral role is in the case when powerful ideas are independent of the existence of the computer. For example, the powerful idea of metaphor has almost not been affected by the presences of the computer. Computers can also play

¹² Part of this section has ever been published in "The Nation" newspaper. Pusawiro, P., CHALK TALK: Computers in the classroom. The Nation. 8 February 2010, 15A. Also available from: <http://www.nationmultimedia.com/home/2010/02/08/national/Computers-in-the-classroom-30122013.html>

the second role as liberators. Certain ideas may have existed before computers, but a computer can liberate them by making them more powerful and accessible to a wider range of people. Referring to Papert, he used modelling and debugging as examples of powerful ideas. This refers to the small subset of ideas that came about through the existence of the computer. An example of an idea that we could not get to know without a computer is programming a computational artifact to behave in certain way.

Papert argued that the power of computers could be in supporting children towards a self-directed approach to learning [Papert, 1999b]. Consequently, the design experiments in constructing an effective learning environment have the same goals as the design of constructionist tools for children. However, we alternatively aim to cultivate the learning environment for students in the higher education context. To make the most of friendliness in using tools, we inspect another design scaffold called “Tools for conviviality” in the next section. This may supply students the greatest opportunity to deepen their pleasurable learning environment with their own vision.

3.4. Tools for Conviviality

Illich initiated the idea of convivial tools in his *Tools for Conviviality* book [Illich, 1973]. He introduced a framework for evaluating man’s relation to his tools by investigating the concept of a multidimensional balance of human life. It is understood that the word *conviviality* refers to the power to enhance personal relations in using tools efficiently, as Illich envisaged that convivial tools would enhance a sort of *graceful playfulness* for personal and social relations, Illich wrote:

“Tools are intrinsic to social relationships. An individual relates himself in action to his society through the use of tools that he actively masters, or by which he is passively acted upon. ... Convivial tools are those which give each person who uses them the greatest opportunity to enrich the environment with the fruits of his or her vision [ibid., 21].”

Exploring Illich’s book, we seek to integrate the convivial inspiration into the design and development process of learning and teaching tools. As we study his work in depth, we agree with his idea that the human can be empowered by the potential of convivial tools. Convivial tools are those, which give each person using them the greatest opportunity to enrich the environment with the fruits of his or her vision. However, “most of tools today cannot be used in a convivial fashion” [ibid.].

According to Illich’s idea, we see a chance that a convivial tool can be enriched as a learning tool for students, as he claimed:

“People need new tools to work with rather than tools that "work" for them. They need technology to make the most of the energy and imagination each has, rather than more well-programmed energy slaves. ... [People] need above all the freedom to make things among which they can live, to give shape to them according to their own tastes, and to put them to use in caring for and about others. [ibid., 10-11]”

According to [Sipitakiat, 2001], conviviality defines a society that prefers the maximization of individual's creativity, imagination, and energy to the maximization of outputs. Illich said traditional schools are clearly the opposite of conviviality, as it focuses on the production of students in an industrial mode.

"A convivial society should be designed to allow all its members the most autonomous action by means of tools least controlled by others. People feel joy, as opposed to mere pleasure, to the extent that their activities are creative; while the growth of tools beyond a certain point increases regimentation, dependence, exploitation, and impotence. [Illich, 1973, 20]"

What is fundamental to a convivial environment is the balance between tools that create the specific satisfaction and those complementary tools that foster awareness in the learning environment.

3.4.1. Convivial Environment and Tools

Exploring the work of Illich, we have seen that the convivial environment may engage learners to the social context in order to encourage them the self-learning on the subject matter and to enrich their environment with their personal meaning. The challenges of this research are: how we can integrate this conviviality into a learning environment and what activities. How we can precede constructionist approach by using tools to promote conviviality. Illich said that:

"When over efficient tools are applied to facilitate man's relations with the physical environment, they can destroy the balance between man and nature. ... [– and] upset the relationship between what people need to do by themselves and what they need to obtain ready-made. [ibid., 51]"

Indeed, it is a balance of hand-head-heart. The convivial tools can allow us to work more effectively and efficiently while still experiencing that intelligent interplay of body, mind and heart that is at the root for meaningful work. This convivial initiative was recently adopted widely for the implementation of Internet technology tools. We agreed that learners should not overly enforce to learn. It should be certainly balance:

"The balance of learning is determined by the ratio of two kinds of knowledge in a society. ... Their first kind of knowledge is derived from the primary involvement of people with each other and from their use of convivial tools; the second accrues to them as a result of purposeful and programmed training to which they are subjected. [ibid., 57]"

According to Illich, the library is the world knowledge repositories and can be analogy as a model of convivial tools:

"Manipulative teaching tools raise the cost of learning. Now we only ask what people have to learn and then invest in a means to teach them. We should learn to ask first what people need if they want to learn and provide these tools for them [ibid., 65]."

Therefore we need to examine how the learners use tools and their relationships when we connected the learners, the tools and the social environments together.

“What we need is rational research on the dimensions within which technology can be used by concrete communities to implement their aspirations without frustrating equivalent aspirations by others. [ibid., 78]”

In linking the convivial idea to this thesis, the above explanation reveals a certain level of the imbalance in using tools. This may be compared to our current tools infrastructure at the university level. We have many services available to students, but it is too overwhelming and overly efficient.

The analysis and critics on tools by Illich was holistic. He concerned the procedures of tools, institutions and systems, which provide goods and services. He provoked questions such as do those tools foster self-realization and self-worth or are they instead manipulative? Illich affirmed in *Convivial Reconstruction* section that:

“Tools foster conviviality to the extent to which they can be easily used, by anybody, as often or as seldom as desired, for the accomplishment of a purpose chosen by the user. [ibid., 21]”

From the *Tools for Conviviality* book, Illich provided a more general exploration of his concerns while criticizing and offering possible standards by which to judge development. However, he explained that he used the term tools broadly. They do not only include tangible productive tools but also include intangible productive system tools that produce education, health, knowledge, or decisions. He requested us “to invert the present deep structure of tools; if we give people tools that guarantee their right to work with high, independent efficiency” [ibid., 10].

Furthermore, he suggested that such tools would enhance playfulness in personal relationship, which he summed up by calling such tools convivial. He claimed that people need new tools to work with rather than tools that work for them. He advocated the need for alternatives and friendly tools that could be controlled by their users that would result in convivial tools to increase a user’s autonomy.

Accordingly, *convivial tools* is a term which best expresses the vision of new tools to enhance the independent efficiency of users. It is a tool with high usability or user-friendly tools.

3.4.2. Characteristics of Convivial Tools

We have clearly seen that the most important convivial characteristic is “Usability”, or the ease with which a tool can be used. It is understood that usability is “the science of making technology work for people”, according to [Slattery, 2007]. Usability is composed of learnability, efficiency, and satisfaction [Nielsen, 2008]. It refers to what is more commonly called user friendliness in common.

It can be seen that such characteristics are related to the general guideline of user-friendly design from Human Computer Interaction (HCI) [Preece et al., 2002] as well as the ISO 13407 standard on Human-Centered Design (HCD) processes for interactive systems [ISO 13407, 2006].

HCD starts the design step by watching people first, to understand them as a user, their needs, and their behaviour. Norman stated:

“The technology comes second. In addition, it means iterative design, where early sketches are tested, then refined and further tested, with this design-test-refine cycle continuing to the very end. [as cited in Slattery, 2007]”

When the focus is on the user, in particular, the design is considered User-Centered Design (UCD)¹³, which is guided by The Usability Professionals' Association (UPA) and has its roots from HCD.

“UCD is a design philosophy and a process in which the needs, wants, and limitations of the end user of an interface or document are given extensive attention at each stage of the design process. ... UCD requires studying the behaviour of the future users of the systems, various approaches have been developed which involve the active participation of real users. [as cited in ibid.]”

Furthermore, Slattery associated the UCD approach to cooperative design, participatory design, and contextual design. First, cooperative design involves the designers and users on an equal footing. Second, Participatory design focuses on the participation of users. Last, Contextual design is a customer-centered design in the actual context, according to *Participatory Design* and *Contextual Design* standard [Slattery, 2007] [Participatory Design, 2004] [Contextual Design, 2008].

¹³ http://www.upassoc.org/usability_resources/about_usability/what_is_ucd.html

According to the *Convivial Tools Database* on the web, it summarized the characteristics of convivial tools can be based on usability design or UCD and affirmed that the typical user of convivial tools wants environmentally and socially friendly tools. There is something in common between convivial characteristics and environmental characteristics.

"One notable example is "Intuitive Operation", ... how to operate the tool without having to refer constantly to the users manual. Another is "Reliability," ... the object should repeatedly prove to be effective, and should operate with few and non-catastrophic errors. [Slattery, 2007]"

Slattery explained profoundly that another convivial characteristic is “*Repairability*”, or the ease of repair. Repairability could be considered part of Usability, to the extent that repairs of the tool are one step in the overall cycle of its use. Indeed, repairability is closely related to “*Durability*”, or the tool’s lifespan. Others include “the quality of the materials and the general robustness of the tool” It is also commonly seen the similar characteristics between conviviality and “*Ergonomics*” – the latter characteristics will notably “tend to increase a tool’s usability”. Another important characteristic of convivial tools is “*Simplicity*: A simple tool tends to be easy to use, easy to repair, and durable”. The next one is “*Robustness*: A robust tool has high usability since it continues to function under adverse conditions”. Followed by “*Repairability*”, it is “open access” because it is more resistant to a user’s tinkering. Lastly, “*Modularity*: A design of standard interchangeable modules”, according to [ibid.].

We use the aforementioned characteristics and criteria as a design guideline for constructing of the learning environment presented in Chapter 6. In the next section, we first discuss and review more tools and digital learning environments that are considered in tune with the philosophies of constructionist learning and convivial tools.

3.5. Computer Tools and Environment in Classroom¹⁴

With ICT, teachers can show students how ICT and internetworking websites are relevant to their study. There is plenty to learn. Users can use these networking platforms to collect information, exchange it, and construct their knowledge. Their pursuit of knowledge via these platforms will be free from space and time constraints. Through websites, students can control their own learning pace.

This paper argues that although innovative approaches to teaching and learning with digital technologies can offer solutions to some of these changes, pedagogical practice has not reflected the dynamic shift in approach that ICT tools can offer to support engagement in learning. New technologies outside school, like the social network environment, can be deployed as a key learning tool based on this technological enhancement. Not only has new technology available in and out of school developed rapidly, but also their development along with the emergence of new devices has been so rapid that educational research and, perhaps more importantly, pedagogical approaches have not been able to keep up.

In a broader view, the impact of computers in a classroom has been strong. However, computer tools have the potential to incorporate more meaningful functions that enhance the process of knowing, process of acquiring knowledge, and the process of learning and thinking. From this viewpoint, computer technology serves as a cognitive tool that enhances the cognitive powers and cognitive process of learners [Sugrue, 2000] [Jonassen and Reeves, 1996]. Considering that computers can facilitate cognitive processing for supporting knowledge-construction via software programs, some researchers view computer applications as cognitive tools. These applications include

¹⁴ Part of this section has ever been published in "The Nation" newspaper. Pusawiro, P., CHALK TALK: ICT offers learning experience for both Teachers and Students. The Nation. 3 May 2010, 15A. Also available from: <http://www.nationmultimedia.com/home/2010/05/03/national/ICT-offers-learning-experience-for-both-TeachersSt-30128444.html>

databases, spreadsheets, semantic networks, expert systems, computer conferencing, multimedia construction, and micro world learning environments [Lajoie, 2000] [Jonassen and Carr, 2000] [Ostwald, 1996]. Computer tools are described as mind tools or knowledge construction tools that support, guide and extend the thinking process of students. This vision focuses on learners learning together, not teachers teaching. So the learners, in this information age, can be able to work, plan, write, design, or communicate both individually and socially via computer software [Jonassen et al., 1999].

There are various forms of tools including visual, audio, text, video, and animation. The multimedia format makes computer applications easily integrated into cognitive tools by creating a more authentic learning environment. Visualization helps students interpret and represent ideas visually and holistically while engaging the learners in further developing their creative thinking skills [Jonassen and Carr, 2000] [Lajoie, 2000]. Those approaches are similar to constructionist learning, so that computers become a tool for externalizing students' understanding, empowering students to reflect their planning, making, learning, and thinking.

3.5.1. Technology: A Big Boost to Constructionist Learning¹⁵

Constructionist researchers' aim is to improve a child's learning ability. Children are encouraged to interact and actively pursue subjects together. This aim not only increases the learner's information-processing ability, but also improves understanding of the subject matter. With modern technology, a well-crafted teaching plan can, indeed, work wonders. It is worth questioning how to bring the constructionist environment to

¹⁵ Part of this section has ever been published in "The Nation" newspaper. Pusawiro, P., CHALK TALK: Technology a big boost to collaborative learning. The Nation. 10 May 2010, 15A. Also available from: <http://www.nationmultimedia.com/home/2010/05/10/national/TECHNOLOGY-A-BIG-BOOST-TO-COLLABORATIVE-LEARNING-30128903.html>

students. In this work, we hypothesize that the convivial technology can improve the learning process and enable ways of teaching much better matched to how students learn.

With tools such as computers, online resources, simulations, games, wikis, blogs, podcasts, web conferencing, virtual learning platforms, RSS feeds, mobile learning, etc., learning has never been easier to accomplish. All students can be readily connected via networks for their shared activities in the technological rich learning environment.

It is understood that students learn better if they are actively involved in the learning process by, for example, having paid keen attention to the topic presented and directly dealing with learning tools. Researchers believe technology may support the mental processes of thinking, perceiving, and remembering when students are encouraged to actively engage in learning, connect to real situations, and frequently provide feedback to the class. However, the use of technology will be effective only if teachers well plan the learning process and class activities. Educational technologies, after all, are just supporting tools in delivering content via their instructional design. The convivial technology can be constructed to boost the students' understanding of the topic as well.

The combination of technological tools and new instructional approaches has a higher chance of success if teachers adopt the pedagogical use of technology, specifically the classroom guideline. Setting up classroom procedural activities should be embedded in the design of the learning environment. The key concept should be transforming computers into interactive learning tools for students to manage their own learning pace.

In the process, teachers should also encourage students to interact with their peers so that they can pursue the subject together. In Chapter 5, we investigate the teaching process in classroom when technology is a component of learning in order to learn the effective use of technology in learning environments. The findings will help set up clear guidelines on how teachers should integrate modern digital tools into their classes for the best advantage of students.

3.5.2. Digital Learning Environment and Emerging Technology

The rapid change in education has been shaped by the development of network technology, especially the emergence of the Internet. A new form of communication medium, the Internet creates an integrated environment for connecting each site or location regardless of time and space. The Internet increases the networked learning environment. The courseware materials can be posted online, uploaded and downloaded anytime on demand. Moreover, the Internet provides the basic services such as email, newsgroup, bulletin board, chats, and the World Wide Web (WWW). These services enable the learning process to become more interactive among students and between faculty members and students. These interactions ultimately result in the sharing information.

As more institutions develop and implement a learning management system (LMS), educational technologists and computer scientists tend to create the necessary black-box technology for these systems to communicate across institutions. Students can personalize and customize their own learning environment when they move from one

place to the next, not needing to relearn the learning landscape or develop new plans with each transition.

The emergence of the Internet and www created a big change in the development of new ways of learning with technology. In the beginning, the Internet served as a platform of sharing class material and as instructional medium. Today both students and teachers use the Internet not only for the classroom purpose, but also for their daily life. This increasing usage of Internet technology as a daily tool does not mean an increased usage of it for educational purpose. Nevertheless, the increasing use of technology as instructional medium has significantly influenced the paradigm shift from teacher-centered to the student-centered learning environment [Jonassen et. al, 1995].

Educational theories such as constructivism, social constructionism, and constructionism have directed a new design approach of technologically rich learning environment, which differs from the design approach of the conventional CAI and ITS. The idea of convivial tools can benefit from the Internet technologies and the aforementioned paradigm. We expect to promote new learning opportunities to the students when we use convivial tools with the right educational theories.

With accessible ICT, the cooperative, collaborative, and interactive aspects of learning activities are strongly emphasized in the development of computer-based learning tools. This leads to a range of emerging technology in education such as Computer-Mediated Communication (CMC), Computer-Supported Cooperative Work (CSCW), Computer-Supported Collaborative Learning (CSCL), Computer-Supported Intentional Learning Environment (CSILE), Open-Ended Learning Environment (OELE), and so on.

It is understood that computer-mediated communication CMC refers to the use of a network of the computers to facilitate interaction among spatially separated learners [Jonassen et al., 1995, 16]. The facilitated tools include email, computer conferencing, and online database to support functions of conversation and collaboration. Palloff and Pratt reported that the most popular application of CMC tools is in both synchronous and asynchronous group communication [Palloff and Pratt, 1999]. In asynchronous mode, the students posted comments to a discussion forum at a convenient time. Students then read, proceed, and respond to the topic under discussion. In synchronous mode, the students or other participants log on to a course site at once and interact with each other in real time. Both have become popular and are regularly used for distance learning or remote education. In CMC learning, the database searching procedure facilitates and strengthens connections between elements of information, having influences on higher-order thinking and meaningful learning [Jonassen et al., 1995, 17].

The next emerging principles are CSCW, which is a research topic in the popular field of HCI. CSCL has been extended from CSCW. It focuses on the use of technology as a mediation tool with collaborative methods of learning. In conjunction with CSCW, CSCL is designed to identify, exemplify, and examine problems with other people who contribute to the achievement of social and collaborative activities [Pea, 1996] [Koschmann, 1996]. CSCL brings socio-cultural issues into the foreground as the central phenomena for conducting computer-supported educational studies. CSCL Tools help a group of students work with diverse functions such as group decision-making systems, project management tools, and electronic conferencing systems [CSCL, 2006]. Some researchers have studied the CSCL field in order to investigate how different tools and

formats impact social interaction and learning or even to identify collaboration levels of specific learning tools [Pea, 1996] [Bonk and Cunningham, 1998] [CSCL, 2006].

CSILE, currently termed Future Learning Environment (FLE)¹⁶, is a comprehensive model for inquiry designed to help students conceptualize and research a problem area via a variety of learning methods, especially group work [Scradamalia and Bereiter, 1994]. This concept focuses on using the network environment to discuss project questions, to collaborate on a project, to share ideas and notes, to identify current knowledge and then publish and view these perspectives through the software program called Knowledge Forum. The FLE project aims to support structured collaborative knowledge building by having students communicate their ideas via a computer platform. The FLE platform provides a knowledge forum module that supports idea exchanges interactively while students can feedback any post via the knowledge forum tools [FLE, 2004] (more details in chapter 5).

OELE denotes a learner-centered environment and aims to promote interactive and problem-solving activities that enrich thinking and learning by using technology [Hannafin et al., 1994] [Jonassen, 1999]. OELE is designed to promote indirect learning environment. The goal of OELE is to immerse learners in rich experiences using various tools, resources and activities with which they can argue and extend their ideas via the open-ended process.

Digital environment empowers the concept of anywhere anytime learning and provides a learning space where learners may control their learning pace and construct knowledge on their own. Learners are able to access a variety of learning material in the internet as well as construct their knowledge through exchanging, collecting, organizing and discussing the material with other students, tutors, or teachers via the networking platform. The emerging web technology enhances the value and impact of educational

¹⁶ Fle3 is a web-based learning environment: <http://fle3.uiah.fi/>

technology. Briefly, the development of the Internet and the web has apparently provided a new manner of constructive learning. Digital learning environments allow a flexible and personalized learning. The internetworking structure provides a ubiquitous access to course material via many resources and experts.

3.5.3. Learning Experience for Teachers and Students

Modern and powerful learning tools are available for teachers to promote learning, thanks to ICT and digital technologies. Appearing in the forms of visual, audio, text, video, 3-Dimensions, animation or simulations, such media can create a more authentic and active learning environment. Computers and Internet can bring the learning process to the next level. Universally, all educators have agreed that students learn better when they have an opportunity to engage with the material related to the subject matter, rather than simply getting a chance to see it and hear about it.

For teachers, they can use such ICT or digital tools to keep students engaged in lessons. With ICT technologies, the visualization is possible and can be designed in a way that encourages students' creativity. Visualization allows students to present ideas visually and holistically. They can rely on computers in externalizing their understanding and reflecting their planning, learning and thinking. Through the Internet, students can search and exchange information conveniently, quickly and easily, aside from engagement in interactive or online lessons. An opportune time has come for teachers to promote new learning opportunities and experiences among students by packaging the digital tools with the right educational theories.

According to the *A Handbook for Teaching and Learning in Higher Education: Lecturing for learning*, in the Making Lectures more effective section, it remarkably referred to Ramsden that:

“Active engagement, imaginative inquiry and the finding of a suitable level are all much more likely to occur if teaching methods that necessitate student activity, student problem-solving and question-asking, and co-operative learning are employed.’ However, in the traditional lecture the student often takes a largely passive role and there is little opportunity for active learning. [as cited in Horgan, 2003, 77]”

We pay attention to the engaging learning approach and believe that classroom management and setting can enhance the learning outcomes of students. In applying technology into a learning environment, we considered the learning process as activity, achieving understanding and lastly social practice, according to [Greeno et al., 1996]. They explained in step: firstly, learning as activity is the process of connecting the elementary behavioural units and the sequence of activity. It is associated with a teacher-centered model of learning, though. Next, learning is to model the processes of interpreting and constructing meaning. Therefore, understanding becomes the key cognitive challenge for a learner. It is a shared constructivism approach. To restate this, the learning is gained through an active process of building new forms of understanding through activity. Lastly, learning is a social and cultural practice.

In Chapter 5, we illustrate our experiments with dialogue techniques using the classroom process. Teachers and students or learners applied a dialogic process to share and exchange the learning style, learning how to learn and then negotiate the

effective learning environment for the community. The teacher should be clear of their roles in order to facilitate this kind of use of dialogues to promote a better way of learning in a course. Heavy digital learning environment should be an obligation as well as engaging students in their comfortable learning. Nevertheless, it depends on how well we design the learning atmosphere, in what culture, in what educational setting and into which learning styles. Giving students choices may be an alternative solution. In next section, we survey a range of applicable state-of-the-art technologies well accepted among communities of learners, namely net generations. Later chapters we foresee how we can assemble the recent digital technologies into the concept we presented.

3.6. Trends Analysis and Social Software in Education¹⁷

Over the next few years, our information landscape will continue to change. We will see new tools emerge and new opportunities in education. New technologies outside classrooms such as social networking applications can become part of the learning. Emerging web technology via sites such as Ning, Facebook, Twitter and MySpace show some of the best practices. Social software has played a major role in changing the way people interact online. Social software can be loosely defined as software that supports, extends, or derives added value from human social behavior. These include message boards, music taste-sharing, photo-sharing, instant messaging, and mailing lists, social networking, according to Coates [Coates, 2005].

The majority of social software tools have been developed within the past 10 years. *One Year or Less: Social Networking* article in Horizon Report proclaimed that:

¹⁷ Part of this section has ever been published in "The Nation" newspaper. Pusawiro, P., CHALK TALK: Powerful ideas come along with a powerful social networking environment. The Nation. 24 May 2010, 15A. Also available from: <http://www.nationmultimedia.com/home/2010/05/24/national/Powerful-ideas-come-along-with-a-powerful-social-n-30130027.html>

“Social networking is all about making connections and bringing people together. ... The heart of social networking is fostering the kinds of deep connections that occur when common pursuits are shared and discussed. [Johnson et al., 2007]”

The newer tools help create and benefit from modern ideas on Web 2.0 technology, which promotes collaboration, sharing, community building from the bottom up, capitalizing on the wisdom of crowds, transparency, personalization, portability, and overcoming barriers of distance and time. The Web 2.0 environments indeed show that learning can take place anytime, anywhere. If the teachers can show to students how these networking web sites are relevant to their study, there is a lot to be learned. Users, for example, can use these networking platforms to collect information, exchange it and construct their knowledge. Their pursuit of knowledge via these platforms will be free from space and time constraints. Through web sites, the students can control their own learning pace.

“[Students] can share information about themselves, find out what their peers think about topics of interest to them, share music and playlists, and exchange messages with their friends. Two of the best-known examples, MySpace and Facebook, have thousands of members who connect daily or hourly. [ibid.]”

New digital technologies are not limited to just web sites. High-tech tools such as mobile phones and video-conferencing systems also count. They too encourage students to communicate, share, and create content. To make the utmost use of technologies, teachers should involve them to enhance learning environments. For example, blogs and Wikipedia can be included in classrooms. Teachers can also use social networking software in connecting with their students within a classroom context. The younger generation may be more familiar with the digital tools but teachers should prove that they are not too old to learn and keep up with the useful trend. Our challenge is how to apply the emerging technology to education. For example:

“[Online] spaces like Myspace and Facebook give students a safe place to gather, in much the same way that young people of previous generations hung out at the burger joint, the roller rink, or the mall. Not all social networking sites are aimed at students, of course [such as LinkedIn]. ... Sites like these, though popular, are not the driving forces behind the adoption of social networking in education, however. It is the intense interest shown by students that is bringing social networking into academia. [ibid.]”

3.6.1. ICT Trends for Teaching and Learning

The concept of ICT has broadened meaning about computer technology in general, but it is sometimes emphasized to digital technologies. Regarding these new technologies, innovative tools create learning opportunities and outcomes that cannot be measured in traditional way. By being technological-savvy, teachers demonstrate that they are really in the process of lifelong learning. By integrating the latest technologies to their classes, they can help students learn more.

According to Johnson, Virtual Learning Environment (VLE) in schools are increasingly common, but often represent content push models that reflect a culture which continues to focus substantially on teaching rather than learning and delivery rather than participation [Johnson et al., 2006]. The tendency here is often to attempt to recreate online the same fixed delivery approach of traditional pedagogies offering little more than a digital version of classroom texts with little flexibility, less portability, and often at a greater expense.

Accessibility to Internet is enabling the learner to create and share information. New digital technologies and media “permit individuals greater control over the creation of content and interaction with others” elsewhere [Siemens, 2008a]. Siemens also coined the term “*Connectivism*” which is the integration of principles “explored by chaos, network, complexity, and self-organization theories” [Siemens, 2008b]. It is networked and social learning. This concept is similar to Illich’s *learning webs* as said in Chapter 2.

“[Society] has moved progressively closer to a networked world where content and conversations are continually at our finger tips and instruction and learning are not centered on the educator [as cited in Siemens, 2008a].”

According to [Siemens, 2008a], technological innovations give a chance to learn and bind the learners around the globe together, such linkage enable the new form of teaching and learning. Through tools such as mobile phones, Skype, video conferencing, instant messaging, along with micro blogging tools such as Twitter, conversations are ubiquitous. Rapid emerging technology can greatly influence education. While it enables our ability to communicate, share, and create content, the technology has created different dimensions not fully reflected in those advancements. In virtual communities on the web, Second Life and Neopets offer dynamic, multidimensional online areas where participants can create, develop, and deconstruct virtual worlds using a range of thinking and creative skills. As a consequence, learner has a competency to learn a new

knowledge. Indeed, we need the dialogue about changing learning spaces and structures for rethinking of classrooms, courses, and programs.

Since networking technology enables a possibility to access to content, experts, and learners worldwide. Bit by bit, new technologies get integrated into our lives. Yet the powerful tool is often unrecognized and undervalued. Activities, which are fun and enjoyable such as the use of computer games, are often considered to be leisure and not learning. Collaborative discussions online as a precursor to or even an integral part of learning is frequently not accepted a valuable. Similar activities conducted face to face, such as group work and discussions in the classroom are considered to be good practice.

Notably the term digital native is reserved for those who have grown up with new technologies, unlike the current generation of educators. According to Prensky, he argues that this generation of young person learns differently and is used to “the instantaneity of hypertext, downloaded music, phones in their pockets, a library on their laptops, beamed messages and instant messaging” [Prensky, 2001, 3], having little interest in more traditional instructional approaches.

According to *Technologies to Watch* section in Horizon Report, Hawkins forecasted and analyzed the 10 global trends in ICT and Education for year 2010 and beyond as listed bellows [Johnson et al., 2009] (read more details from Horizon Report website)¹⁸:

¹⁸ 2009 HORIZON REPORT: <http://wp.nmc.org/horizon2009>

Trends in ICT and Education

- Mobile Learning
- Cloud Computing
- One-to-One computing
- Ubiquitous learning
- Gaming
- Personalized learning
- Redefinition of learning spaces
- Teacher-generated open content
- Smart portfolio assessment
- Teacher managers and mentors

These trends are really challenge to all researchers in the *Technology in Education* field to explore how to implement such ICT into education in practices, especially in mainstream and formal education.

3.6.2. Web 2.0 and Social Networking¹⁹

Increasingly advanced technology and ICT trends, as presented in the Horizon Report discussed in the previous section, can greatly contribute to the learning and teaching process. Clearly, all educators should take advantage of it. Web 2.0 Technology is commonly associated with web applications that enhance interactive communication, sharing information, interoperability, user-centered design, and collaboration on the WWW.

According to the *Educational Social Software for Context-Aware Learning* book, it conveys that the most relevant aspects of Web 2.0 for education are digital tools that bridge personal and social worlds [Lambropoulos and Romero, 2009]. Shirky defined the term social software broadly as software that supports group interaction [Shirky, 2003]. Lee and McLoughlin said that many social software applications straddle the virtual and real social worlds, as they entail online and offline interactions and various forms of visual and verbal connectivity in both synchronous and asynchronous modes [McLoughlin and Lee, 2007]. In *Emerging Technology Initiative: Relevance for Teaching, Learning, and Creative Expression* section reported that:

“Because of students’ tremendous interest in social networking, colleges and universities are increasingly going to be seeking ways to employ the same strategies that make social networking sites so effective. ... [Some campuses] are investigating the way social networking is being used, evaluating existing tools, and even developing new ones. [Johnson et al., 2007]”

¹⁹ Part of this section has ever been published in “The Nation” newspaper. Pusawiro, P., CHALK TALK: Web 2.0: Learning platform for Higher Education. The Nation, 21 June 2010, 15A. Also available from: <http://www.nationmultimedia.com/home/2010/06/21/national/Web-2-0-Learning-platform-for-Higher-Education-30132000.html>

Social networking sites are growing so fast on the Internet, integrate into higher education websites and bind people together powerfully. It can build rich, interactive and robust learning communities [Johnson et al., 2007].

It is common known that the term Web 2.0, originally coined by Dale Daugherty and made popular by O'Reilly Media International, is essentially meant to capture an idea rather than any particular media tool or technology [as cite in O'Reilly, 2005]. Though the meaning is difficult to capture and continues to change, at its most basic level it means that participants in the new media Internet landscape are now afforded more opportunities to create, change, control, and participate with the media rather than acquiring information from it [Boutin, 2006] [O'Reilly, 2005]. The tools and practices afforded by the Web 2.0 concept, along with an increasingly information-rich 21st-century world, further demand instructional design strategies, practices, and models that are able to capture the potential that these accessible, adaptable, and growing list of tools offer [Kaiser Foundation, 2005] [Reigeluth, 1999].

A Web 2.0 site allows its users to interact with each other as contributors to the website's content, in contrast to websites where users are limited to the passive viewing of information provided to them. Web-based communities, hosted services, web applications, social networking sites, video sharing sites, and wikipedia.com all rely on this marvellous technology. When combined with the Internet, Web 2.0 has the potential to transform how humans live, work, and communicate in education. They are using it not only in daily life, but also for classroom learning. Mejias commented that social software could positively impact pedagogy by inculcating a desire to reconnect to the world as a whole, not just the social part that exists online [Mejias, 2005].

Web 2.0 learning platform, therefore, comes as a candidate tool to help students achieve extraordinary learning results in classrooms, laboratories and beyond. With Web 2.0 technology, the learning environment can have an active role in promoting interaction, networked communication, discussions, integration, and add to the daily lives of the student community; offering users a range of pathways, modes, and styles of learning. It also offers rich opportunities for the individual empowerment of students within multiple learning modalities, which are the sensory channels or pathways through which individuals give, receive, and store information.

Students are known to learn better if they think about what they are learning and have an opportunity to engage with the learning materials, rather than simply get the chance to see it and passively use it. This is why the read-write properties of Web 2.0 can help. The Web 2.0 technology allows a two-way communication, something vital to students. Today, Web 2.0 applications, such as blogs, wikis, podcasts, Really Simple Syndication (RSS) feeds, social tagging, Mashups, Twitter, Facebook and so on are focused on the creation of communities that allow people with common interests to meet, collaborate and learn from each other. Therefore, educators can use such technology for their students' benefit. However, the educators must realize that the Web 2.0 is just a tool for education. It is not supposed to replace lecturers in classrooms. The focus of learner-centered education moves closer to reality regarding web technologies and social software development.

The development of Wikipedia, blogs, podcasting and free online communities such as MySpace, YouTube and even Friends Reunited are raising questions and challenges to academics about the nature of learning and how to analyze and how to draw

meaningful conclusions from non-static and non-textual electronic data. The current generation of teenagers expects access to computers, mobile phones, programmable videos and CD players in their day to day life, whilst the culture in schools continues to restrict that access, seeing them to be of limited educational value. Indeed, access to some of these tools demands problem solving ability and higher-level ICT skills.

Although the goal of education is to effectively teach students, it has paid scant attention to learning in a variety of forms. Young people have used new technologies to develop new learning into innovation and creativity. Much of this learning has taken place at home because most schools do not recognize the value of many of these new ICT devices and web-based environment. It appears that the very fabric of the education system has failed to fully recognize the value of computer technologies in learning. As a consequence pedagogical approaches have not changed quickly enough. Education has remained embedded in a system developed for the 20th Century and does not comprehend how to educate the child of the digital age, hence disengagement from learning has become an increasing problem.

A new generation has redefined innovative pedagogy using the same technological tools so frequently barred by schools. We, accordingly, have to re-think about educational system that has for too long been a one-size-fits-all structure. Meanwhile, we have to readily recognize the way young people learn with new technologies. Learning outcomes and measurable outputs will need to adapt to reflect this. Clearly, resistance to technological innovation as a tool for learning is deeply embedded in the education system itself. Although pedagogies have moved away from didactic towards more collaborative approaches, content and targets appear to have greater significance than how a child learns, what they learn with, and how they demonstrate that learning.

Survey Web 2.0 and Social Software

In fact, pedagogical approaches have not changed quickly enough. Education has remained embedded in a system developed for the 20th Century and does not comprehend how to educate the child of the digital age; hence disengagement from learning has become an increasing problem.

A review of educational social software has shown that no single educational software and no single educational activity based on computer software can address the expectations of all students. Thus, educational social software and activities, which are to be performed by students, should be carefully selected in order to meet the diverse needs of all students, and make them achieve expected learning outcomes. Moreover, the selected social software should also support support students to share content each other. The method of integration of educational social software should be based on one or more of learning theories. The answers to questions, *"how do students learn with technology"* and *"how can the content be delivered through technology"*, which are related to educational practices and activities, should follow a learning theory. Moreover, the integration of social software should also meet basic learning needs and goals for students. Certain technologies such as internet and web tools supporting individual and collaborative learning, classroom presentation, discovery, exploration, synchronous and asynchronous communication, and distance learning provide environments for teaching that focuses on students' individual strengths [Nelson, 1998]. Hence, instructors should effectively integrate social software into their courses to prepare students for their future career as lifelong learners.

As to the social software, blogs provide users with a platform for people to post messages for others to view and respond. Moreover, the blog users can upload files, images, sounds, video, etc. to create more interesting content for their viewers. Distinct from blogs, a wiki is a type of web site, which enables the students to add, remove, and edit the available content, and includes the collaboration of work from many different authors. That is, wikis can be viewed as a community for collaborative documentation. Discussion forums may also include the linking of images, videos, sounds, or other types of files with the help of other web sites offering opportunities to upload content. Chat programs and e-mail provide the opportunity for sharing all types of files as attachments. Transmission of information is sent in real-time in chat programs, whereas there is a little time delay in the e-mail method, depending on the status of the servers.

In this chapter, we have seen that prevailing technologies and mainstream tools can be blended into the learning environment are summarized. Considering the advantages, opportunities and educational applications, social software can be integrated into many courses in various ways and can be used to create, modify, share, publish, and store course content while also offering communication flexibility. In short, the use of latest technology to communicate and share resources will provide students the chance to develop or improve their ICT skills and become lifelong learners, a quality expected of all students of the 21st century.

Powerful Ideas and a Powerful Social Networking Environment²⁰

Social networking can play an important role in enhancing powerful ideas, when it comes to technology related learning. Students can explore new information, express thoughts, and share ideas that will pave the way for new ways of thinking. It is understood that these technological tools can establish a new learning ground for any subject. Social networking can connect students with friends, colleagues, or even total strangers. They can express their ideas on various topics of common interest.

However, the social component of the Web 2.0 platforms should not be underestimated as users engage in a high level of interactivity with technology and with other users. More important to this discussion, however, is the role of the Web 2.0 in educational pedagogy. Web 2.0 allows students to move away from tighter control of teacher or instructor organized activities and curriculum to a context, or platform, where a variety of loosely constructed learners are able to establish and control how they learn. In the words of Anderson, students have the freedom to create their own learning [Anderson 2004]. In other words, social software in relation to Web 2.0 allows and provides ways for transitioning static websites into fully interlinked and often interactive computing platforms where users can create, as well as use, content from other participants. The primary driver of Web 2.0 is the recent development in people's ability to create and publish content online, or in what has been termed as "*read/write web*" [Richardson, 2009].

As confirmed by Siemens and Cormier, Social media and emerging Web 2.0 technologies - blogs, wikis, Ning, MySpace, podcasts, Facebook, Twitter, Second Life, cloud computing, surface computing and mobile learning - are gaining increasing

²⁰ Part of this section has ever been published in "The Nation" newspaper. Pusawiro, P., CHALK TALK: Powerful ideas come along with a powerful social networking environment. The Nation. 24 May 2010, 15A. Also available from: <http://www.nationmultimedia.com/home/2010/05/24/national/Powerful-ideas-come-along-with-a-powerful-social-n-30130027.html>.

attention in higher education and are having an impact on today's trends in learning and teaching [Siemens and Cormier, 2009].

The Horizon Project Research also identified that social networking software are likely to have a large impact on teaching, learning, and creative inquiry at colleges and universities within the next five years:

"Students are tremendously interested in social networking sites because of the community, the content, and the activities they can do there. ... This is the next step after portals: to harness the power of social networking to build rich, interactive, robust learning communities. [Johnson et al., 2007]"

It is commonly understood that social networking has the power to further open the world to students, through a shareable, computational, dynamic and interactive environment. It enhances digital literacy and technological fluency. Students live in a technologically rich culture where there is deep knowledge about, familiarity with and passion for building and applying technology towards the attainment of personal, group, or social goals. The current boom of social software tools can foster technology fluency in learning.

In summary, social networking sites are the fastest growing, most used sites on the Internet. New social software may become a mainstream tool, as blogging and Internet Messenger (IM) got accepted, as they support activities in the physical world and can enhance the face-to-face interaction. On the other hand, some tool may be less popular. Wikis are a great tool, but some students cannot find a practical use for them in their learning and drilling down information causing wikis not to be used.

Technology will be trendy if students see it as a useful addition to their daily or academic lives. Facebook is a good example; it has been designed for use at either the global or a local level. While Facebook is available to qualified users all over the world, each academic institution has its own Facebook. Students can click to access the class webpage and see who is taking the same classes. Indeed, campus social software makes it easier for an institution to keep up with what their students are talking about, as though students can keep up with technology. These social applications provide both public and private learning space and let student groups, academic departments, classes, and project groups develop their own academic space. This makes college students among the most prolific users of social software, promoting not only peer-to-peer but also networked learning.

Example of Web 2.0 and Learning Platform: Facebook Scenario

Regarding the popular Facebook application, it can be represented as a specific Web 2.0 Platform for learning. Instructors and students can use social software effectively for their learning. Founded in February 2004, anyone can sign up for Facebook and interact with the people they know in a trusted environment.

Its popularity among students has been well noted to the extent that membership was restricted to individuals with academic based e-mail addresses [Read, 2006]. Due to the popularity of the site within the college environment, many educators and administrations find themselves under pressure to use or formulate an adequate response to the Facebook phenomenon.

Social networking sites like Facebook also have the power to connect [Bolanle and Indi, 2010]. They foster a way to supplement face-to-face interactions rather than replacing them altogether. Hence, application of social software and Web 2.0 can be geared towards students' learning processes in ways that maintain their connection to the classroom and to the instructor. From this standpoint, social software and Web 2.0 can offer solutions. On the other hand, social software may help adult learners who already possess certain experiential knowledge to continue their life-long learning. Consequently, instructors may be better adept and justified in yielding more control in the learning process while fostering an effective learning environment.

There is evidence that social software like Facebook can increase effective learning from the perspective of both instructors and learners. For example, Berg, Berquam, and Christoph suggested that a careful consideration of "how students use social technologies can help educators build a strong network of information," and aid us in how to "think differently about how educators communicate with students and with each other" [Berg et al., 2007, 44].

The Facebook "wall" can be used to facilitate discussion about upcoming assignments, and to clarify any student's concerns or questions. This functionality can also be used to provide students with a type of "status check" in regard to classroom schedules and alleviate confusion that may have occurred during face-to-face or classroom based lectures. By placing the class into a unified Facebook group, instructors can also email the entire class at once, sending updates or other important class related information. To enhance these interactions, instructors can facilitate tutoring sessions, or hold office hours online in order to allow their students to contact them through a more student accessible mode of communication. Teachers can also send reminders to students about impending deadlines.

For student-student interactions, students on Facebook can connect with other students. Students can form teams for studying, or completing projects and assignments with one another. Students can also create online groups that allow real time interactions [Berg et al., 2007].

For student-content and instructor-content interactions, instructors can design or utilize the wealth of online resources to allow students to explore, in-depth, various aspects of the subject matter being taught. Students can conduct personal research on a subject matter and broadcast their findings to their group or the entire class as an add-on to the information provided by the instructor, according to report from [Waterhouse, 2005] [Mejias, 2007] [Achterman, 2006] [Jakes, 2006].

As closing remark of this chapter, Facebook, like other social applications, can foster collaboration and provide interactive computing platforms where users can be both a creator and a user. In this thesis, we affirm that learning can be hard, but fun. We attempt to set up a convivial environment that boosts fun in learning. There is the need to make students learn by making learning attractive. Within the Web 2.0 environments, a teacher may by nature have a very small role in regards to direct student instruction. They would simply provide guidance in using tools and facilitate the students' effort in learning because the learning process does not exist in the tools themselves. Social networks can inject various learning directions into the learning environment and may best be applied to transform classroom process.

4. HIGHER EDUCATION

Higher education is broadly referred to education at the college or university level and the various types of education given in postsecondary institutions of learning. At the end of the study program, a degree, diploma, or certificate of higher studies is usually awarded [Britannica, 2001]. According to *A Handbook for Teaching and Learning In Higher Education*, it proclaimed that

“Learning may involve mastering abstract principles, understanding proofs, remembering factual information, acquiring methods, techniques and approaches, recognition, reasoning, debating ideas, or developing behaviour appropriate to specific situations. Despite many years of research into learning, it is not easy to translate this knowledge into practical implications for teaching. This is because education deals with students as people, who are diverse in all respects, and ever changing. Not everyone learns in the same way, or equally readily about all types of material. The discipline and level of material to be learnt also have an influence on learning. [Fry et al., 2003, 9]”

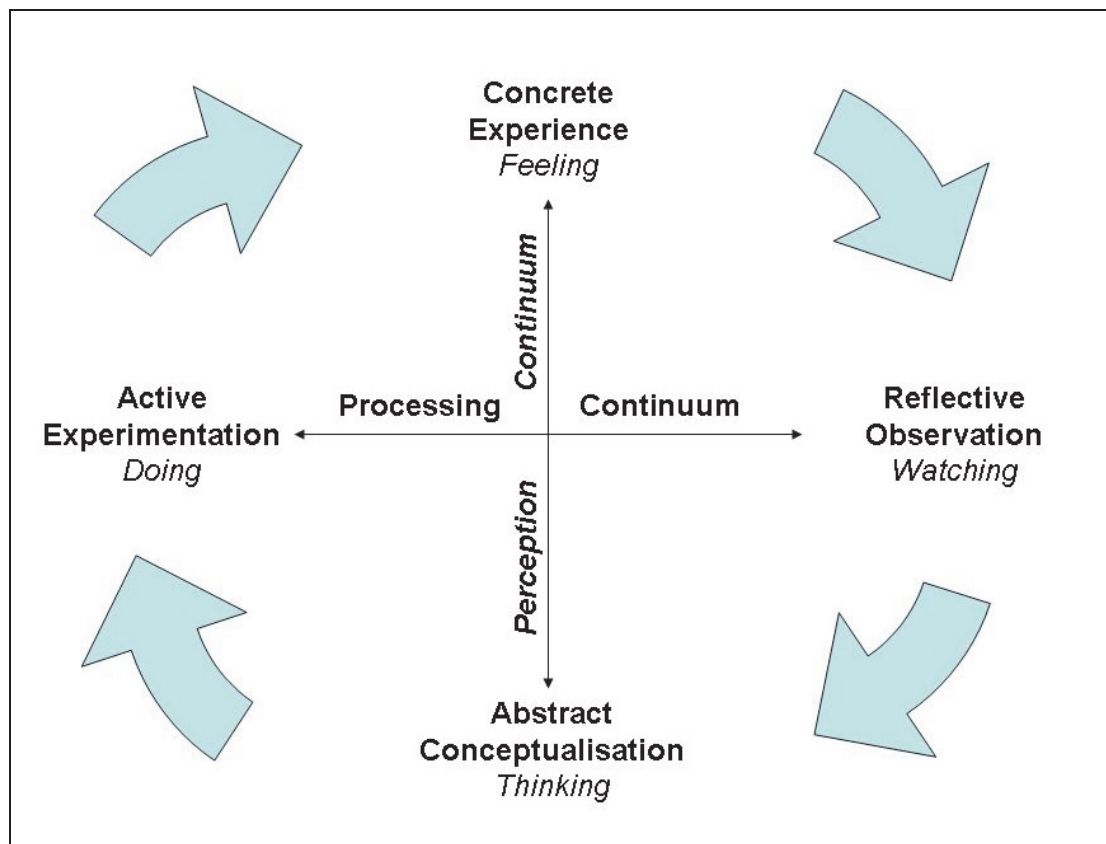
In order to explain how students learn, we found that many researchers in *the handbook* considered the constructivist pedagogical approach as their basis. It is commonly known that understanding is transformed via learning and the use of reflection; people can actively construct their knowledge [Piaget, 1972] [Papert, 1980] [cited in Fry et al., 2003, 9]. We explained, in chapter 2, about how people learn based on educational theories referred to as constructivism, social constructivism, and constructionism. We affirmed that learning involves a process of individual transformation that empowers the students to actively construct their knowledge.

Knowledge is a primary learning outcome in higher education. According to [Hativa and Goodyear, 2002], the three kinds of learning in higher education include: academic, generic competence, and individual reflexivity, so the students are required to acquire competence in academic discourse, especially in their development of academic understanding. On generic competence, students should develop analytical skills, self-discipline, communication skills, ability to collaborate, questioning attitudes, and flexible learning capabilities. Another essential attribute is reflection, as shared with [Dewey, 1933]; students must learn to be reflective learners. Therefore the role of reflective observation is part of learning model, according to [Kolb, 1984], Kolb proposes experiential learning theory and explained the role reflection in “do-observe-think-plan” as shown in Figure 2.

Thus, basically, we ground our attention to the design of a learning platform that provides maximum opportunity for communication, reflection, and collaboration. In order to foster the four-stage learning cycle in Figure 2, we also perceive that the learning focuses on understanding knowledge and learning in context, and places importance in learner engagement with others to develop and create collective understanding as part of a community.

Figure 2 : Experiential Learning

(Source from [Clark, 2004])



In this chapter we scope the idea about student learning in higher education, specifically, how they reflect, think, communicate, and transform priori knowledge to further understand the subject matter. In the following sections, we will explore the purpose, characteristics, and specification of higher education. We then examine the academic teaching and learning at universities and survey what kind of ICT has been deployed for Campus Learning Management System (CLMS). Finally, we bring together this knowledge of higher education, ICT, and learning processes to chart out a direction for a self-construction learning platform in higher education.

4.1. Characteristics and Specification

4.1.1. Academic Understanding and Knowledge Acquisition

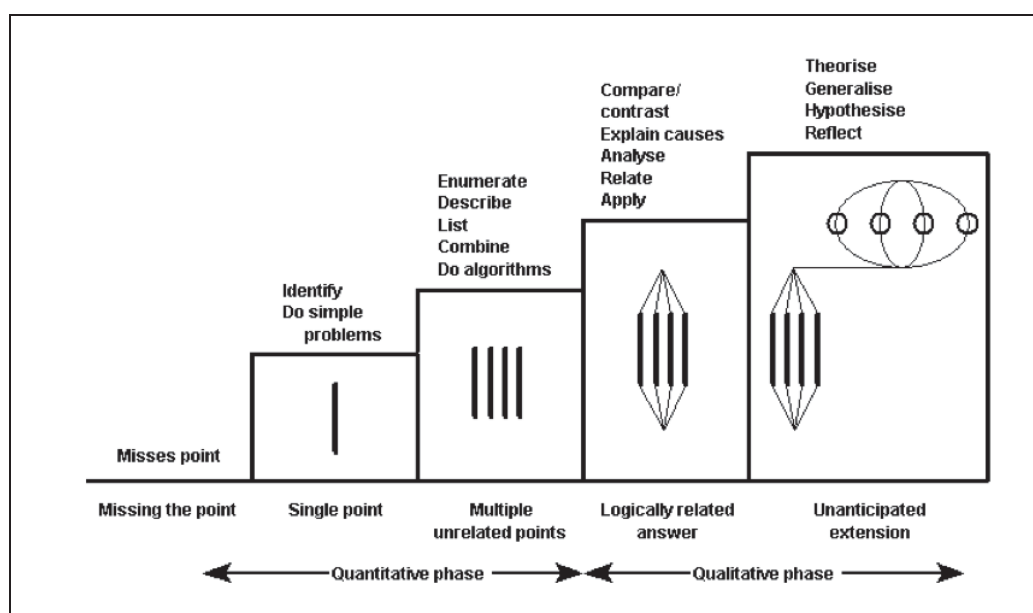
Higher education requires students to acquire competence in academic discourse. The university has to setup an environment and create opportunities to enable academic learning through various approaches. Fry and team found that work of Marton and Saljo investigated the interaction between students and a set-learning task in order to understand professional learning in higher education. They concluded students learned and engaged to tasks deeper to understand the context of meaning, as said:

"[That learning requires an in-depth approach] is typified as an intention to understand and seek meaning, leading students to attempt to relate concepts to existing experience, distinguishing between new ideas and existing knowledge, and critically evaluating and determining key themes and concepts [as cited in Fry et al., 2003, 18]."

Of course, academic learning aims to provide professional development and disseminate knowledge to students. Studies on academic teaching and learning in higher education reported that the best way to learn in a university setting is not to be given information and advice, but through exposing students to practice and learning through active involvement, practical experience, and reflection or thinking about the learning [Kolb, 1984] [Carr and Kemmis, 1986].

Figure 3 : Structure of the Observed Learning Outcomes (SOLO)

(Source from Learning in a Technology-Rich Environment [LITRE, 2006])



In JISC review of e-learning theories, frameworks and models [Mayes and Freitas, 2004], it clarified the nature of understanding in academic contexts by expressing different levels of understanding as learning outcomes and adopted the view that real understanding depends on how a learners' performance grows collectively in complexity when mastering academic tasks. It is called Biggs' SOLO structure as depicted in Figure 3. Interestingly, this is similar to the constructionist view of a learner in the development of understanding.

Marton and Booth asserted, "learning is about how we perceive and understand the world, about making meaning" [as cited in Fry et al., 2003, 9]. Ramsden also suggested that approach to learning was not implicit in the make-up of the student, but something between the student and the task; thus, it is both personal and situational [as cited in ibid., 18].

The above approaches contribute to the concept of situated learning that has an associated social theory of learning [Vygotsky, 1978] [Lave and Wenger, 1991]. The researchers of situated learning view learning as a social practice and believe new knowledge can be generated from practice and shared by others. In short, learning in higher education involves academic understanding and knowledge acquisition.

4.1.2. Learning Styles: Teachers and Students

In higher education, the awareness of learning style is also important for the lecturer planning a course or syllabus. Thus, we should consider the multitude strategies to promote learning. As said by Sheull, "it is important to remember that what the student does is actually more important in determining what is learned than what the teacher does" [as cited in Fry et al., 2003, 22].

Biggs suggested the crucial step is to judge whether the learning and teaching processes adopted will really achieve the learning outcomes [as cited in Mayes and Freitas, 2004]. Since students bring different backgrounds and expectations to their own learning, one needs to start by carefully defining the intended learning outcomes. Thus, the learning and teaching activities that stand a good chance of allowing the students to achieve that learning should be chosen [as cited *ibid.*].

The academic strategy in higher education should empower students to engage with and take some responsibility for their learning. The teacher should ensure that the course design and the choice learning approach help the learner to actively construct knowledge as well as to be able to think, perform, create and innovate at a relatively high level. As studied by Barnett, learning requires space for thinking or reflecting in the student mind and for interaction with others including learning from and with peers and experts [as cited in Fry et al., 2003, 22].

To design the appropriate learning space, the researcher should understand how students learn, how they recall their learning and combine parts of it together in order to apply the learning knowledge in creative and innovative ways. Thus we foresee that understanding the learning process and styles of study in higher education is premised to design the learning environment. In next section, we explore how we can relate the academic competency within a social context.

4.1.3. Academic Competency and Social Interaction

According to social constructivism in section 2.2.3 and 2.3.2, we presented the aspect of social interaction in the process of knowledge construction. Lave and Wenger state that participation in social practice is the fundamental form of learning [Lave and Wenger, 1991]. Meanwhile, in the realm of higher education, Bertrand expressed the importance of social learning, situated context, interactions among individuals, participation, collaboration, and socially shared cognition. The learning community's model centers on the advancement of the collective knowledge of the community and, thereby, helps the development of individual student learning. It focuses on the development of the culture of learning in which everyone is involved in a collective effort of understanding in social practices. The group of people is "informally bound together by shared expertise and a passion for joint enterprise" [as cited in Wenger and Synder, 2000, 139].

The essential components are the creative activities that promote self-directed learning and empower students' initiative. There is no right or wrong way in academic teaching and learning in higher education. However, it is imperative to understand the learning styles of students who attend the class. Actually, there is no single technique, but, instead, lots of feedback, openness and cooperative activities, and discussions are essential in a classroom.

Regarding constructivism and constructionism in chapter 2, we presented the importance of a learner's thinking processes rather than on the teacher's action and the environment within a classroom. It focuses on a learning theory and the tools that enable the learning. The learners determine and control their own path of learning development. In other words, the learner is a self-directed learner with a keen readiness to learn. It is an attitude towards empowering or freedom to learn [Shor and Freire, 1987, 109]. Therefore, it is not simply limited to a classroom situation, but ultimately should lead to social intervention.

Papert, discussed earlier in chapter 2, endorsed thinking about learning that students need help to recognize their own learning needs and to find strategies to meet them. The university also has a responsibility for recognizing these needs and provides learning resources, materials, and infrastructure in order to boost students for their learning. Learning is possibly typified as an intention to complete the task, memorize information, and make no distinction between new ideas and existing knowledge. It is a surface learning like rote learning. At the campus level, however, lecturers face the challenge to seed deeper conceptual learning during the class hours and to ensure that their teaching suits the different learning styles. Thus, a community or social support is needed. Presently, it is crucial to change the view on teaching as consisting only of lectures to one in which students are supported in their learning, as explained in *Supporting Student Learning*:

"A simple transmission model of teaching is even less adequate to meet the needs of students than it was in the past. ... Higher education no longer operates entirely on a teacher-centred model of teaching and is shifting, albeit slowly and hesitantly, towards a more student-centred model. ... Part of being 'student centred' is recognizing that, although there is a subject content which all students must learn in order to pass, each student approaches the subject from their own perspective, their own unique past experience and their own understanding of themselves and their aspirations. ... All students have their own learning needs that must be met sufficiently well for them to succeed. ... it assumes that all students are engaged in a learning development process and structured learning support is designed to provide assistance to help students meet their goals. [Gosling, 2003, 163-164]"

Since most universities are increasingly open to heterogeneous groups of students from diverse cultures who have a wide range of educational experience behind them, researchers suggested that the need for a more systematic approach to supporting student learning becomes ever more important in higher education, according to [Gosling, 2003] and Higher Education Funding Council for England [HEFCE, 2006]. In next section, we focus on teaching and learning processes that become apparent at university.

4.2. Teaching and Learning Processes²¹

4.2.1. Pedagogical Process

Pedagogies in Higher Education

In order to design our research to fit into the above framework, we explore how the pedagogical process in higher education should work effectively in classroom learning. As we explore the literatures of teaching and learning in higher education, in this chapter, we find that the more a student is engaged in a rich learning environment, the more motivated is the student to be involved and to think about their learning. The aim of teaching and learning within a university is to create the students' understanding of knowledge and subject matters via participation, negotiation, and dialogue. According to the pedagogy on higher education, the activities of educating or teaching impart the knowledge or skill.

Indeed, the meaning of pedagogy is both the science and art of helping students to learn. According to [Maia, 2005], the classic pedagogic model at all levels of education is based upon the instructive model, where instructional sequences tackle the task of transferring the maximum amount of information between an active teacher and a passive learner, Maia found that the instructive model tends to be standardized and homogenized in a sense that the teaching is mostly directed to the class as a whole, and not to individuals within the class, so that knowledge is absorbed by progressive structure of the experiences, evolving by means of an interactive process of construction as said by [ibid.].

²¹ Part of this section has ever been published in "The Nation" newspaper. Pusawiro, P., CHALK TALK: Happiness is a key factor amid all the education choices. The Nation. 20 September 2010, 15A. Also available from: <http://www.nationmultimedia.com/2011/02/10/opinion/Happiness-is-a-key-factor-amid-all-the-education-c-30148375.html>

Last but not least, Barnett claimed that the main pedagogical task at a university is not to transmit knowledge but to develop a human in three dimensions of being: “knowledge, self-identity, and action, in pedagogies” [Barnett, 2000, 163].

An alternative to the instructive pedagogic model is the constructivist theory – the teacher or instructor plays not only the classic role of transmitting knowledge, but also serves as a facilitator of the learning process. According to Piaget in chapter 2, knowledge, at any level, is generated by a radical interaction between the individual and their environment. In the constructivist model the student is the central focus of the whole process of knowledge construction.

4.2.2. Gaining Knowledge

In *An educational philosophy guides the pedagogical process* paper, Petress explained the relationship between what students know and what they are seeking to know [Petress, 2003]. Therefore, students need to become aware and tolerant of the fact that not all students are equally active or articulate in the pedagogical process, as said

“Knowledge is heuristic; that is, each new idea, skill, or concept spawns additional learning forming a lifetime spiral. ... [To gain knowledge] includes the ability to recognize and use observed and experienced relationships between phenomena. Knowledge includes the ability to weigh alternatives, to make wise and meaningful choices; to adapt to new and changing situations; to know how and when to ask questions of specification, clarification, amplification, reinforcement, or interest; and to be able to clearly, directly, relevantly, and cogently articulate what we do know to others through oral, written, and behavioral means. [ibid., 128]”

Moreover, knowledge is enhanced when learners accomplish the skill of connecting what they know holistically. Literatures suggest that teachers need to maintain enthusiasm, humanity, and preparation no matter what else is transpiring in their lives outside the classroom or university. Furthermore, students need to be encouraged and taught to participate in classroom discussions. Then students may organize and express their thoughts via that class discussion. Well-run classrooms typically form close group cohesion; and such cohesion is partly the product of universal participation and contribution.

Certainly, students become empowered and they focus and pay close attention to others, fostering good listening. In other words, most learning occurs in a social setting, though some learning is done individually. Relating to classroom discussions, students need to learn and consistently practice interpersonal respect. As a consequence, it is important to design a class climate that fosters more open and comfortable discussion as well as to develop student-learning skills in order for them to work cooperatively and to critique constructively. Indeed, to gain knowledge, students often learn from each other apart from the texts and lectures.

4.2.3. Lecture Process

In *The Handbook in Higher Education*, Horgan describes the lecture method as a means of promoting student learning [Horgan, 2003, 75-76]. The analysis explains that university teachers in many disciplines use the lecture approach as a method of teaching as said:

“Primarily, lectures are seen as necessary for providing background information and ideas, basic concepts, and methods required by students before they can learn much on their own and become effective participants in classroom discussion. [ibid.,76]”

The reasons that most teachers use the lecture method for instance; lectures can help communicate the enthusiasm of teachers for their subjects and can dramatize important concepts and share personal insights, as studied by Cashin [as cited in ibid.]. Importantly in literature reviews, researchers have a similar focus on active engagement in order to promote student activity, student problem-solving, question-asking, and cooperative learning. The key issue is drawing the attention of students in a classroom.

We share the opinion that it is important to develop student-learning skills in order for them to work cooperatively and to critique constructively. Most of traditional lectures are about one to three hour slots. Various studies on attention levels during a fifty-minute lecture reveal that attention levels are high only for the first 10 minutes, and drop dramatically unless the student is actively involved in some way. Learning of material can be consolidated if students are given the opportunity to use it within a short period after its initial presentation. Students use note taking as a means of maintaining attention during a lecture, as an aid to memory, and as the basis for revision of the material covered.

Hogan asserted, “it is important to give students opportunities to develop their own way of structuring new material rather than imposing a rigid framework on them” [ibid, 79]. The lecturing and teaching method should consist of guiding rather than governing student learning. As it happens, some students do not learn well if the lecturer is too highly organized, according to McKeachie [as cited in ibid.]. A good lecture in higher education needs to be a structured and well-planned learning experience. It should shake students out of the passive role and provide a challenging learning environment, according to [ibid, 88-89].

As a consequence, we need to encourage students to take more responsibility for their way of learning. In practicing so, both teacher and students should promote active interaction and communication via any kind of media or tools. At this point, the learning platform can play an important role to enhance the learning.

Better Teaching More Learning

The components in a classroom include teachers, students, subject, and setting. Teaching is defined as the interaction of a student and a teacher over a subject in the specific setting [Davis, 1997]. To gain a perspective on what happens in the classrooms in higher education, one should be clear on the conceptual structures to make sense of the classroom environment where the teaching and learning take place. The settings are the elements of physical space and social structure that affect classroom communication

and interaction. The strategies in the classroom may support to control, focus, and organize the interaction among students in the course. Therefore, we need to be able to think more clearly about the activities in a classroom setting. Relating to higher education, the term strategy refers to a plan and a series of activities used to facilitate a particular kind of learning. Most of what teachers do can be conceptualized into several strategies, namely strategies and method for obtaining a specific goal or result, according to *Clear Thinking about Teaching* in [Davis, 1997]. To implement our research, we adopted the following strategies for better teaching and more learning to our classroom experiments, as presented in Table 1.

Table 1 : Five strategies of better teaching and more learning

(Adopted from [Davis, 1997] [http://www.ntlf.com/html/lib/btml_xrpt.htm])

Strategies	Method
"Training and coaching"	"Developing basic and advanced skills by using clear objectives, breaking instruction into steps, and reinforcing progress".
"Lecturing and explaining"	"Presenting information in ways that it can be attended to, easily processed, and remembered".
"Inquiry and discovery"	"Teaching thinking skills, problem solving, and creativity through inquiry and discovery".
"Groups and team"	"Sharing information, working cooperatively on projects, and exploring attitudes, opinions, and beliefs through group processes".

The five strategies, together with the perspectives of component in the classroom provide the basic professional information related to teaching and learning in higher education.

4.2.4. Student Competency in Higher Education

According to *The New Science of Learning*, it introduced how students are educated and suggested schooling perspectives. Indeed, the goal of schooling is to train students on the facts and procedures from simple to complex one. First the students learn the simple content and later should be trained and taught by teachers, so that "[students] are considered to be educated when they possess a large collection of these facts and procedures" [Sawyer, 2000, 1]. Although there are various studies of how people learn, most universities have designed the teaching and learning based on their commonsense assumptions that "the way to determine the success of schooling is to test students to see how many of these facts and procedures they have acquired" [ibid., 2].

For students, the generic competences in higher education emphasize on the qualities of “confidence, self-discipline, communication, ability to collaborate, reflexivity, questioning attitudes”, according to the *Review of e-learning theories, frameworks and models* [Mayes and Freitas, 2004, 12]. To accomplish these outcomes, the community approach is often suggested with special “attention to learning environments that provide maximum opportunity for communication and collaboration, such as networked learning environments” [ibid.].

Referring to chapter 2, Papert restated the conventional perspective of schooling is known as instructionism [Papert, 1993, 137]. Also, the *Cambridge Handbook of the Learning Sciences* reaffirmed that “Instructionism prepared students for the industrialized economy, [but it] is increasingly failing to educate our students to participate in this new kind of society” [Sawyer, 2000, 1]. To Illich, he mentioned the economical idea and learning attitudes in his *Deschooling* book. As shared with [Sawyer, 2000, 2], the industrial world today is much more technologically complex, thus teacher cannot just instruct students to learn better, instead students need to learn integrated and usable knowledge, actively participate in their own learning and reflect on what they learn.

Reflection has been emphasized in higher education at least since Dewey wrote about it in the issue of the *Science Education Journal* [Dewey, 1916]. According to Cowan, he strongly affirmed the crucial role of reflection in higher education [Cowan, 1998]. Students must learn to be reflective learners

Regarding the disciplinary practices of discourse and representation, learners also are encouraged to establish collaborative learning and learning relationships with peers. In so doing, task analysis may be defined as “sequences of component-to-composite skills. It provides a highly focused set of objectives, described as learning competencies” [Mayes and Freitas, 2004, 13]. Since many learning outcomes in higher education refer to mastering a skill, most competences that are relevant comprise both conceptual understanding and procedural knowledge [Biggs, 1999] [Hativa and Goodyear, 2002].

As said earlier, “Knowledge is a collection of facts about the world and procedures for how to solve problems” [Sawyer, 2000, 1]. Such viewpoint “encourages us to formulate learning outcomes in terms of authentic practices of formulating and solving realistic problems” and emphasizes on “conceptual development” which is the “importance of achieving understanding of the broad unifying principles of a domain” or a subject matter, “with the educational aim of achieving learning how to learn, and encouraging the development of autonomous learners”, according to [Mayes and Freitas, 2004, 13]. To have more competencies and get deeper understanding in subject matters, the next section explores the teaching and learning processes that empower students to get involved in the real learning situation.

4.2.5. Deeper Understanding and Dialogical Process

The more a student is involved in a real world situation, the more he or she will gain a deeper understanding. Therefore it is important to create an appropriate learning environment that will allow students to reason about real world problems. Comparing to traditional learning:

“Deep learning requires that learners understand the process of dialogue through which knowledge is created, and they examine the logic of an argument critically [and] requires that learners reflect on their own understanding and their own process of learning. [Sawyer, 2000, 4]”

To better understand how to engage students in authentic practices is to understand on a new conception of the expert knowledge and the experience of professional practices [ibid., 5]. Furthermore, to foster the communities of learner, students should practice in communication and interaction in order to share their dialogue in a learning environment, specifically the discussion platform. As said: “the students gain deep knowledge when they engage in activities that are similar to the everyday activities of professionals who work in a discipline” [ibid., 4]. This is analogous to the *Learning Webs* idea of Illich.

The dialogical process is another key. Students learn better when they express and reflect their developing knowledge through their artifact such as reports or dialogues via the discussion forum. Several researchers emphasize the importance of the dialogue process in learning. For example, Freire and Shor advocate to the openness of the dialogical educators that both students and educators stimulate each other “to think, and to rethink the former thought” through dialogue and “dialogue belongs to the nature of human beings, as beings of communications” [Shor and Freire, 1987, 3]. Freire affirmed “dialogue is a moment where humans meet to reflect on their reality as they make and remake it” [ibid., 98].

Indeed, new methods of teaching and learning in higher education should provide the dialogical environment in order for students to develop their own voice and allow them to participate more actively. So far we do need a dialogue process to enhance the reflective and participatory learning in higher education. To conclude, we have seen that the involvement of the dialogue process may provide a sense of ownership in the classroom and enrich the deep understanding and the sharing atmosphere for academic learning in higher education.

4.3. ICT in Higher Education: Traditional Proposition

In a traditional classroom communications allowed for rapid spontaneous interaction and face-to-face allowed interaction via body language like gesture, expressions, position and voice expression to be communicated. Presently, computer could store, process, and reproduce large bodies of data, and supplement the communication function in educational establishments, but permit a limited dialogue between machines and users. Somehow, ICT can augment the learners from a personal learning to social learning.

Regarding the literature survey on ICT policy at universities, it is generally accepted that ICT can shape new ways of teaching and learning practices in higher education. For

instance, Oblinger and Rush stated that computer tools challenge the education establishment to rethink itself and education as well [Oblinger and Rush, 1997]. Some researchers [Collis and van der Wende, 2002] [van Merriënboer et al., 2004] investigated the circumstances of ICT usage and delivery in higher education.

In brief, in the beginning, the simple technological tool for education was email that then extended to the web that can connect applications and services on the network. Currently, the web is expected to involve more and more network applications that are available to access via the Internet. This current movement of ubiquitous and mobile technologies provides a huge improvement for higher education. Computing and communication have been merged with the networking of the computers. With the agreement on the standard wireless application protocol (WAP), many developments of wireless web applications and services have emerged. These developments will raise the wireless transmission speeds to allow for running various multimedia applications with transmissions via handheld or mobile devices such as a smart phone or tablet PC.

We have also witnessed few practices from emerging technologies being applied to teaching and learning in the higher education context lately. The challenges are the deploying process of ICT into a real classroom, and then use that technology for teaching and learning effectively. Presently, many new tools and digital media technologies provide new opportunities for teachers and learners to interact and communicate during the course. We start this section by exploring the evolution of classroom technologies and the former research of using technologies in higher education (see more in section 4.4) in order to progress to the right track for design of constructionist learning environment for university.

4.3.1. Evolution of Classroom Technologies and Instructional Technology

Dating back to the early years of ICT use in a traditional classroom, the standalone computer or desktop personal computer (PC) was the main tool. In the 1980s, we experienced the introduction of the PC and in the 1990s experienced the advent of the Internet on a limit telecommunication system that had been designed for telephones. The beginning of the broadband network involved the exchange of information in all forms – voice, data, text, images, audio, video – transmitted over computer-based networks.

The emergence of the Internet in 1990s made that single PC connected via a telecommunication infrastructure. This change brought a new paradigm of data and information exchange. It is not limited to text, but also included voice, images, audio and video, owing to the development of data communication and computer network technologies. The campus library could be accessed remotely in order for students, teachers, and researchers to access the library catalogue and to check for available books or journal articles. All these legends established a relationship between users via the network computer or the so-called Cyberspace. The classroom dialogue could happen not only face-to-face, but also via internetworking and could extend to the outside of a classroom, such as at a dormitory or cafeteria. Thus, learning can take place anywhere anytime for the age of digital media. It is sometimes called ubiquitous learning.

From that point of ICT review in our work, we have seen that the rich technological environments and the network infrastructure are now in place and readily available. However, rich pedagogical use of the technological infrastructure is still in the

developmental phase. The research on strategic use of ICT for different target groups still needs to be considered explicitly and investigated thoroughly in order to find out the right process of deploying technology into the real classroom, not only for E-learning or distance learning.

Concerning the issue of technology integration into higher education, a literature survey from various journal of instructional technology showed that new tools, like wikis have been introduced into the classroom since 1997 [Friedman and Heafner, 2007] [Richardson, 2009] [Solomon and Schrum, 2007]. In order to gain a better understanding and improve classroom practice, an attempt was made to explore more possibilities of technology-mediated instruction. Some researchers suggest to consider the pedagogical process rather than technology itself and to apply the technology for a range of pedagogical techniques [Hammond and Manfra, 2009].

As to above evidences it is shown that the change and reform in using technology in higher education is rather slow in. Institutions have hardly anticipated radical changes in teaching practice resulting from, or related to, the use of ICT. However, some institutions increased the flexibility in using ICT without altering the underlying pedagogical model. Furthermore, it is reported that ICT in teaching and learning are commonplace but just part of a new blend of the on-campus delivery system.

As a consequence, the use of email and web resources is more frequent in educational practices. The rich technological environments have been used more for course preparation and out-of-classroom activities than for communication and in-classroom activities. Mostly, the computer server for lecture materials is still the mainstream medium. Some teachers extensively use the ICT, though without seriously re-thinking the deploying process. Moreover, instructors often increase their ICT use, but do not actually change their approach to teaching. The success use of technology in the classroom depends on the pedagogy, not technology. This affirmation is the direction of our work in deploying an appropriate teaching and learning environment into the classroom.

4.3.2. ICT Integration into Learning Environment

Rapid advances in ICT and human computer interaction (HCI) have contributed new tools and technologies, which provide new opportunities for teachers and learners. The purpose of this section is to explore relevant developments in ICT and the implications for learning and teaching in the context of higher education in order to realize the potential of ICT to enlarge learning opportunities. In order to share information and knowledge in a learning platform, Greeno suggested that a student might apply “a wide array of technologically advanced tools along with old-fashioned pencil, paper, chalk, and blackboards” [as cited in Sawyer, 5]. It is assumed that gaining knowledge is a process involving the students: “the tools and other people in the learning environment, and the activities in which that knowledge is being applied” [ibid.].

As the full potential of the HCI is developed, a further explosion of the use of multimedia is likely to occur enabling people to communicate in even more dynamic ways. To create a digital campus:

“IT has become as pervasive and expected as basic utilities within most campuses, and users' expectations for service continue to increase. In response,

many institutions are eager to add new technology applications and systems that will expand the reach of applications to more users, enhance services, and increase efficiency. Instead, institutions must strive to unify all of their disparate technology applications and systems into a single digital campus. [Moul, 2003]"

This perspective move beyond a transmission and acquisition conception of learning is important since, in addition to acquiring content, the patterns of participation in collaborative activity change over time during learning, according to Rogoff [ibid.]

Typically, different technology systems support teaching and learning. In particular, the CMS or LMS hosts the applications that allow faculty members to integrate technology into the classroom. In general, both CMS and LMS include applications for managing content, communicating, and interacting with students remotely. The following sections present the selective applications that have been designed as technology-based learning tools and have supplied technology-based learning material to support learning for decades.

Hypertext

According to [Barker, 2004], Literature reports of technology-based learning materials indicate that text and hypertext have been widely used to support course material teaching. Hypertext allows text to be structured and accessed in ways that improve the efficiency of the descriptions. For example, the teacher may provide a link to further details, which need only be followed by those students who feel they need to be told more. Publishing text and hypertext on the Internet so that it can be accessed on demand can enhance its availability with a search facility to direct the students to the relevant information. On the other hand, when lots of text appears on a computer screen, students have been known to adopt a rather passive learning style while reading the text. Also an overly complex web of pages may leave students feeling rather lost,

Multimedia and Simulation

Various multimedia resources are frequently used to enhance the presentation of the concepts being taught, both as a supplement to verbal presentation in a lecture or to textual presentation in a computer-based tutorial. Multimedia has been shown to enhance the teacher's explanation of a concept. It can also be used to enhance the student's description of their understanding of a concept in response to the teacher.

Simulation differs from other forms of multimedia in which they use a computational model of a system to mimic the behaviour of that system. Given different input parameters, the distinction between modelling and simulation software is that with modelling software the student can build the simulation himself or herself. The most common modelling software used in higher education for engineering applications includes the various computer-aided design (CAD) tools for creating a simulation of electronic circuits or architectural designs. The educational use of simulation and modelling is that it allows the teacher to construct a world within which the student can perform tasks. As a consequence, the student may actively engage with the consequences of the idea that underpin the concept being taught.

Communication Tools

Communication between tutor, teacher and students is a core part of teaching and learning. Either asynchronous or synchronous technologies such as bulletin boards, forum, chat and email have been used to facilitate this communication. In some cases, a tutor sets up a discussion forum where students were required to submit a minimum of short postings on a topic of their choice. Students may reply to other postings or start a new topic. This kind of participation in a discussion forum helps students learn from their peers. However, the most difficult aspect of using a communication tool when teaching is persuading the student to use it. In our experiments, we asked students to access a discussion forum regularly, even making it compulsory to access.

Tutorial systems and Managed Learning Environment

Tutorial systems are software packages that bundle together resources to deliver learning material to the students via hypermedia or hypertext over the networking of Internet or intranet. The adaptive contents page may show links to topics on the course, which the student has studied or has been ongoing during the course. This mode of learning support is typically suitable for students studying alone and may be used to replace lecture hours in a course. Typically, they will comprise a textual and graphical explanation of a topic, which may be supplemented with simulation-based activities for the student, similar to Computer Aided Learning (CAL) [Badcok et al., 1996]. However, this kind of application has been shaped and integrated into Managed Learning Environment (MLE).

A LMS, also known as a virtual learning environment (VLE), is software that synthesizes computer-mediated communications with online delivery of web-based course materials [Barker, 2004]. The LMS should allow a course tutor to mount course materials on a web server and create conferencing or discussion forum for students. Access to these materials and services should be controlled on a class-level basis, which requires that the system needs to keep a database of users, their status, the coursed they are taking, etc. In some systems this database may be linked to university information management system or MLE. LMS should provide tools for discussions, which are integrated with the learning material being presented to the students. It should allow the teacher to adapt the activities to individual students, provide feedback on student progress, allow students to interact with the learning material and how it is presented to them, and help the student and the teacher reflect on the student's actions. The IMS Learning Design specification suggested functionalities necessary in LMS: resource negotiation, coordination, monitoring, individualization, self-organization, and adaptation [IMS, 2006]. These functions can support students in working together in groups without being led by the teacher and to be able to contribute their own materials. They also concluded that LMS systems have a potential to be of great benefit in supporting modes of learning which would otherwise be time-intensive using traditional methods; for instance, collaborative learning, discussion-led learning, student-centered learning, and resource-based learning.

Internet

Networking and Internet enable users to interact and open a wide arena of educational conversation that could eventually replicate and even extend most forms of classroom communications. With the development of the Internet and advances in networking, a

unique opportunity for interactive education emerged that can be offered at a distance and to a large number of people. These developments have opened up the possibility of collaboration with experts worldwide. Bandwidth is integral to the opening up of new technologies for teaching and learning. Broadband allows for greater speed in communications and greater flexibility.

The early use of internetworking for learning was centered on email. At the beginning, the Internet was connected as a stand-alone application on specific computers or intranet. The next step was move onto the Web where the applications and services are accessible globally via the WWW. The current and future trend is expected to involve Networked Applications and Service Oriented Architectures. Here, the technology trends are towards more extensive use of the Internet, digital fiber-optics, and wireless technologies catering to high speed local and global internetworking for voice, data, images, audio and video exchanges. Higher education gain a benefit from that communication exchange, aforesaid data can be upload and download throughout the Internet regardless locations or machines.

Web-Based Technologies

The early role of the WWW in higher education was designed to provide material and to support content of the curriculum for instruction called Web-Assisted Instruction (WAI) and Web-Based Instruction (WBI) [Rogers, 2000]. In doing so, the web and digital media technology have been employed to supplement face-to-face teaching and to deliver course materials via a hypermedia learning environment. Later, those platforms have incorporated more communication and interaction modules in order for students to have alternative channels in exchanging messages, objects and knowledge.

The Internet and virtual environment not only increase the complexity of the learning situation but also provides a wealth of learning options. This makes learning with technology extremely challenging. However, not all computer-supported learning environments have been successfully employed in the educational sectors. In order to achieve constructionist learning, the technology must be easy for students to master and transparent in the learning process. Besides, technology participation of students and instructors are important factors for achieving successful learning in a technologically rich environment. As the Internet becomes a cognitive and knowledge management tool beyond its unique technical features, students are getting more active and individual-centered in their learning. The real strengths of the Internet in the educational context are in content, connectivity, and community [Brown, 1999]. In terms of content, the Internet provides an excellent learning content to the students and fosters students' generative learning based on their self-authorship for learning that content. Next, the Internet's connectivity allows students and instructors to engage in the thinking process that are of a higher order than the ones they would develop without its connectivity. Finally, the Internet connects students into communities of learning or links them to other experts [Brown, 1999, 35].

To make this happens, teachers must be well-prepared in thinking about the teaching and learning process before, during, and after the instruction of both online and face-to-face environments. So, we need to carefully scrutinize how educational technology has ever been used for effective teaching and learning, and then foresee what kind of research is further needed.

4.3.3. The Learning Environment and Educational Tools

ICT has a potential to shape of the classroom settings, create a new form of relationship between teacher and learner, and offer an interactive and digital tools to support new ways of teaching and learning, open up access to knowledge across networking. Technology allows a greater participatory and collaborative society. We found a majority of research work related to school systems, especially on child-learning with technology in schools, on active engagement of learners in rich learning tasks, and on active, social construction of knowledge and acquisition of skills. On the other hand, research is still rare in the higher education context.

It is necessary to explicitly develop the knowledge on technologically rich environment for higher education, since ICT offers a more flexible and wider access to learning than was ever possible before. We affirm that empowering the students to use ICT for their learning is serving to enhance the value of teacher teaching.

Several scientists on learning charted the scope of using ICT in higher education for engaging in and enabling critical thinking and higher-order learning through the use of technology [Kirschner et. al, 2006] [University of Twente Netherlands, 2002]. Subsequently, students may use technology to collaborate on projects and to work with teachers and other experts. Moreover, students may use ICT for learning to interact with others, building and sharing knowledge through technology, using technology in a meaningful way, and then being aware of the wider social implications of technology use. The above awareness may imply the importance of self-reflection on using technology.

The above findings showed that the traditional campus-based model still dominates the use of ICT in teaching and learning. Even though web-based systems would produce more efficient practices, they cannot yet replace traditional methods of teaching such as lecture. Thus, technologies become part of the on-campus blend in delivering ICT. In

other words, ICT is being used to complement traditional on-campus settings and the potential of the new technology to transform the teaching and learning environment. The realization into campus is still on the developing way in higher education. (See more educational tools comparison from EduTools)²²

In earlier section, have presented how ICT can benefit academic teaching and learning in higher education, particularly, to enrich and enhance students' productivity. This work describes how to design effective constructionist learning environments by means of emerging technology and social networking tools. Then in next section, we review researches and techniques that attempt to deploy learning environments in higher education. We have seen varied technical effort that plan to dynamically maintain heterogeneous LMS and MLE platform for the higher education, but it is still on the way to realization.

4.3.4. Unified Campus Platform and Identity Management

Unified System

The learning environment system becomes more complex and develops in the direction of a Campus Management System as a campus web portal. This is also the case at the University of Bremen where various CMS systems serves students and faculty members, in an attempt to diminish barriers to faculty members and students that may be caused if a single technology was deployed for teaching and learning services.

Since the campus support systems are not unified, users may need to enter multiple systems to access all of their data such as student data, curriculum, course offering, registration, library access, and so on. For example, WebCT, Blackboard, and First Class

²² WICHE Cooperative for Educational Technologies: <http://wcet.wiche.edu/> and <http://edutools.org/>

are stand-alone systems with no integration to allow data to automatically flow amongst the applications and the administrative system. Another problem is each faculty or college may have its own computer center with its own installation of the application software. This makes a cross disciplinary course more difficult to administer since the application must run across faculties. Without integration most universities have the same concern and difficulty in managing the learning management software.

"Integration is lacking because most vendors provide integration only for their own administrative systems and related applications. ... IT staff must spend considerable time building the interfaces and then upgrading and maintaining them. ... Because this task is costly and time-consuming, ... many institutions do not tackle the challenge, allowing shadow systems to co-exist throughout the campus. [Moul, 2003]"

Actually the focal point of unification is intended for users, not the university. In doing so, the computer center may "take a holistic view for [student's] needs and make all the services that they require available [ibid.]" ubiquitously and can be accessed anywhere anytime via the campus network. This is not an easy solution. Nevertheless, by bringing a wide range of applications into a single platform; a university can increase the quality and number of services available to students, faculty and staff members, reduce inefficiencies, and improve the effectiveness of teaching and learning.

Another solution in some campuses is through running "batch processes to move data from one system to the next, but this method can be cumbersome and slow" [ibid.]. Moreover, students or staff may need to re-enter their data into another system, if they do update their personal data after the batch processing. Technically, the recommended solution is to merge information from diverse systems, deploy the Lightweight Directory Access Protocol (LDAP), and manage just one account per user, called identity management or single sign-on.

Identity Management and Interoperability Standard

A single sign-on or identity management is an alternative solution for unified digital university: "enables real-time, bi-directional integration update between administrative systems and other applications, including those from different vendors and those built" [ibid.] by universities. System integration also reduces the data-entry burden on the administrative staff and promotes interoperability: students "have one entry point to all information they need, ... even though the data reside in multiple systems" [ibid.]. As a consequence, students can submit homework and learn collaboratively from a single sign-on.

The attribute of interoperability allows the many different end users to use the different types of computer systems, software packages, and databases provided by a variety of interconnected networks. According to Moul, these functions support interoperability among different platforms and systems. Standard Internet technologies such as XML and HTML will provide the support needed for real-time interoperability [ibid.]. Through information exchange as announced by World Wide Web Consortium (W3C), XML messaging enables the system to talk each other. Last but not least, "Web Services will allow dissimilar systems to interact and integrate over the Web" [ibid.] [W3C, 2004].

Recently, the emergence of social networking software has changed the direction of integration. At this moment, the unified system may not be the only option. Meanwhile, technologies are ever changing and tools are emerging regularly such as Social Networking Software. After unifying and integrating the old system, a new application is entering the ICT market regularly. It might be better fit than the older tools. So what is the alternative to unifying the existing systems? On this issue, our research has explored other possible factors that empower the student and the instructor to co-work effortlessly and share their learning resourcefully enclosed by constructionist learning environment. Later, in next section, we survey the use of technology in higher education in order to search for a better way to improve the campus-learning platform.

4.3.5. The Use of Technology in Higher Education

Generally, the teaching process in higher education is defined as the interaction of a student and a teacher over a subject matter. There may be one student or several students in a class including various types of instruction.

According to [Farren, 2005], she reported that higher education has less awareness to anticipate radical changes in teaching practice resulting from, or related to, the use of ICT. The use of ICT increased without altering the underlying pedagogical model within universities. New teaching with ICT on-campus changes slowly, while students seem to have high performance in using ICT and technologies. Moreover, ICT in teaching and learning are widely used as a blend in the learning and teaching. Most instructors deploy ICT as a tool in the classroom, but hardly change the way they have been teaching in the class. To conclude, the study shows that the traditional campus-based model still dominates and ICT is integrated on-campus and is being used to complement traditional on-campus settings. Studies of the impact of technology on teaching and learning in higher education indicated: “teachers in general are making use of email and web resources but more advanced technologies” [ibid.].

Most universities provide a campus-learning platform, such as web portal, content management, or learning management application, to their lecturers and convince faculty members to incorporate various technologies into their teaching and course content. This may benefit students to meet expectations of the workplace for a rapidly changing information rich society. Researchers suggest this technology integration may support student-centered instruction and collaborative learning [Barr, 1998] [Barr and Tagg, 1995] [Entwistle et al., 2000] [Hannafin and Land, 2000]. However, Garrison and Wilson independently argue that student-centered teaching and collaborative learning do not happen by simply making technology available and providing instructors with the technical knowledge [Garrison, 1997] [Wilson, 2006]. Importantly faculty members must also have the understanding required to design and implement teaching and learning strategies supported by technology appropriate to the development of knowledge in their disciplines [Laurillard, 2002]. Otherwise technology may not help [Saroyan and Amundsen, 2004]. Meanwhile Littlejohn concluded that the use of technology in higher education is most often influenced by traditional models of teaching and learning familiar to instructors, often resulting in passive and didactic forms of teaching and learning [Littlejohn, 2002].

Amundsen and Sohbat report the potential use of computer mediated conference (CMC) in higher education and document how instructors integrated a computer conferencing tool into the on-line courses in order to understand the relationship

between technology and pedagogy [Amundsen and Sohbat, 2008]. The conventional use of technology, like website of course outlines and lecture notes, email assignment submissions, class mailing lists, online references, drill and practice software, and only contact with the lecturer, are perfectly legitimate uses of technology. Despite that, some researchers seek to deploy alternative tools for participation and reflection, peer tutoring, close monitoring of student learning and time and space extension of classroom learning [Chong, 1998]. It is understood that the new features may support instruction beyond traditional didactically based approaches, and provide opportunity for collaboration [Garrison, 1997] and knowledge construction [van Aalst, 2006] [Ostwald, 1996].

According to [Kirschner and Gerjets, 2006], they focus on the use of ICT as a core technology, in particular, learning how to use ICT and learning via ICT. The former focuses on helping teachers gain competencies with ICT. On the other hand, the latter refers to the use of ICT as a core technology for participation, mainly through the use of web environments as tool to support flexible learning for teachers. It is also important that students should familiarize and appreciate the effects of ICT in order to increase autonomy, authentic activity, learning styles, situated learning, and motivation. This can potentially engage students in critical thinking and higher-order learning for academic study. To do so, they propose to facilitate meaningful professional thinking and learning such as mind-tools [Kirschner and Davis, 2003]. Such tool can help mapping and represent visualization systems. Then, students can represent what they know as they transform information into knowledge. Kirschner has continually studied the profound effects on teaching and learning in higher education and summarized the following *Benchmarks for Teacher Education Programs in the Pedagogical Use of ICT* [Kirschner and David, 2003]:

- Adapting technologies to better teaching and learning
- Planning for relevant individual, group, and whole class activities
- Preparing and producing learning materials with the help of ICT
- Dealing with the possibilities and consequences of using ICT
- The social aspects of ICT is learn to share and to build knowledge

Such benchmarks recommend how to engage and interact the learners via the use of technology. Thus, the emphasis is on learning via interaction with others, building and sharing knowledge through technology, using technology in a meaningful way, and being aware of the wider social implications of technology management [Kirschner, 2005]. However within higher education, “the idea of active engagement of learners in rich learning tasks and the active, social construction” of knowledge and acquisition of skills are still underway, according to [Farren, 2005].

The students may develop the learning skills and create their own multimedia and web based artifacts in order to improve their learning. This can be enhanced through the process of developing ICT artifacts out there. As shared with Farren, she concluded that ICT has a potential to change the shape of a classroom; “change the relationship between teacher and learner; offer new tools to support new ways of teaching and learning”; and open up access to knowledge across internetworking [ibid.].

Notably, we must understand how students learn with ICT and what environment we should design to support them to learn. As to this thesis, we argued that there is a need to develop rich pedagogical uses of ICT that involves the social and collaborative construction of knowledge. ICT offers a flexible and wider access to learning than was ever possible. Higher education has been slow to break with the traditional norm. In connecting to teaching, we should line up the pedagogic approach with learning theories, and then insert the trendy technologies into the new design technology for a constructionist-learning environment.

We study how we can support instructors to think about technology in terms of supporting student learning and how they go beyond traditional didactics in using a technologically rich environment. We see the need of pedagogical thinking and action that potentially leads to course designs that add the appropriate and effective features of a computational learning platform.

4.4. ICT in Higher Education: Trendy Proposition²³

The competency of students in using technology in higher education has been shaped by emerging technology, especially via handheld devices and mobile technologies. New technologies can bring much excitement to learners. The competencies of students in using technology in higher education have been commonplace and integrated in daily life. Given that some students have wonderful experiences, they have found smart phones to be cool devices for learning and teaching.

²³ Part of this section has ever been published in "The Nation" newspaper. Pusawiro, P., CHALK TALK: Learning trends through handheld devices. The Nation. 9 August 2010, 15A. Also available from: <http://www.nationmultimedia.com/home/2010/08/09/national/Learning-trends-through-handheld-devices-30135469.html>

Smart phones like Android, iPhone, and Blackberry are now a big trend. A large number of people, including students, carry them around to stay connected with not just their friends or family, but also the Internet. Therefore, it may be a time for teachers or lecturers to start working with these devices as part of their mission to help students learn better.

There is a massive amount of knowledge, namely open content, including free online lessons and courses, out there in the Internet. Lecturers should, therefore, first of all guide their students on which ones to pick and rely on. Indeed, so many contributors now upload lessons and useful educational content online for others to use for free or at a very little cost. Many free lectures are also available via iTunes and YouTube. Such open content has significantly boosted the availability of information to students and independent learners. Students, at this point, should be advised about where to look. Students need the skills of finding, assessing, interpreting, and synthesizing information, which the lecturers can help cultivate.

Then again, there is technological help for those who know where the assistance lies. For example, there is the technology trend for collective and selective content such as Really Simple Syndication (RSS) feed. Known as aggregation, it is the process of transparently gathering together distributed pieces of online content. The relevant topic or the author can then categorize such content. RSS readers or feeds are one way to aggregate data. With such a tool, learners can easily track-distributed conversations that take place across blogs, Twitter, and other publishing platforms, as well as pull in relevant resources from news feeds and other sources.

Such technology can make a big difference in the educational sector. Students can access their course materials, discussions, assignments, and grades almost anytime, anywhere if their teacher or lecturer have jumped on the bandwagon and made the utmost use from the available technology. In fact, lecturers and students can even share their thoughts, ideas, and experiences related to learning via mobile or handheld devices. Several universities, after all, have already made their courses available for mobile delivery.

Although this increasingly hi-tech world is changing the role of teachers or lecturers from the transmitter of knowledge to a facilitator or coach for learners, a teacher's role is still very important. Therefore, in our work, we investigate how best to apply the new technologies relating mobile devices, portable computers, handheld, or other Internet-capable devices to the learning context. Then, we have seen a trend that we should design the course and class activities in a way that matches the new generation's lifestyle. The following sections, we investigate the trendy technologies and its potential to use in higher education.

4.4.1. Wireless, Mobile and Web 2.0 Technologies

As wireless access grows dramatically, new ways of learning and teaching in education appear. Mobile networking is installed in many universities in order to support anytime anywhere learning. Ubiquitous accessibility is a basic service nowadays. The emergence of the net generation has opened a new form of learning and teaching in higher education via communication throughout the Internet. Students enter a university with their prior exposure to ICT knowledge. Some already have experience in social interaction and peer-construction of knowledge via social networking software.

Moreover, the facade of social network software has enabled people to view content and collaborate throughout computer-mediated communication and other forms of online communities such as Posterous, Facebook, Twitter and MySpace. These available social networks can have an impact on ICT in education, as said:

“the nature of communication on the Web has been deeply transformed recently, with the introduction of tools and services which allow for a much greater participation of people in the generation of online material. There is a new generation of students who are accustomed to these technologies and who use them to share knowledge and information outside the strict context of the traditional classroom. Navigating the Web, we can see people of all ages taking active roles in geographically disperse communities, collaborating and building knowledge through interaction and self-regulatory social dynamics. [Simões and Gouveia, 2008]”

The advent of Web 2.0 technologies has rapidly expanded the pedagogical possibilities [O'Reilly, 2007]. Tools such as Google Present, YouTube, TeacherTube and NextVista can create large online libraries of user-generated slide and videos by moving them onto the Internet. The former study of the new generation relating to the development of networking technologies state that students of the current, traditional university age range of 18 to 24 belong to a generation called Millennials [Strauss and Howe, 2003].

According to [Simões and Gouveia, 2008], they said most of students have online exposure with “a profound impact in their individual personality, in the way they relate with other people, and in the way they see the world”. Tapscott reported this group of people growing up with Internet and mobile phones are acquainted with multitasking capabilities and getting fast interactions with information channels and have an intrinsic desire for connectivity [as cited in *ibid.*]. The researchers called these students the Net Generation or Generation Y [Oblinger and Oblinger, 2005]. For this generational classification, ICT plays an important role in their living and learning towards the Web 2.0 direction, including multimedia, the digital world, cyberspace, and social networking. To summarize, Web 2.0 tools are a powerful medium for technology-enhanced learning and enable students to create their own content.

4.4.2. Potential Use of Web 2.0 and Social Influence in Higher Education

Referring to chapter 2, Constructionism and social Constructivism emphasize the negotiation and the co-construction of meaning with others. Concerning the emergent of Web 2.0 tools, O'Reilly refer it to the “revolution in the computing industry caused by the move to the Internet as a platform” [O'Reilly, 2005]. It covers various applications, for example, “Blogs, Mashups, Wikis, feeds to social bookmarking, social networking and media sharing sites” [as cited in Simões and Gouveia, 2008].

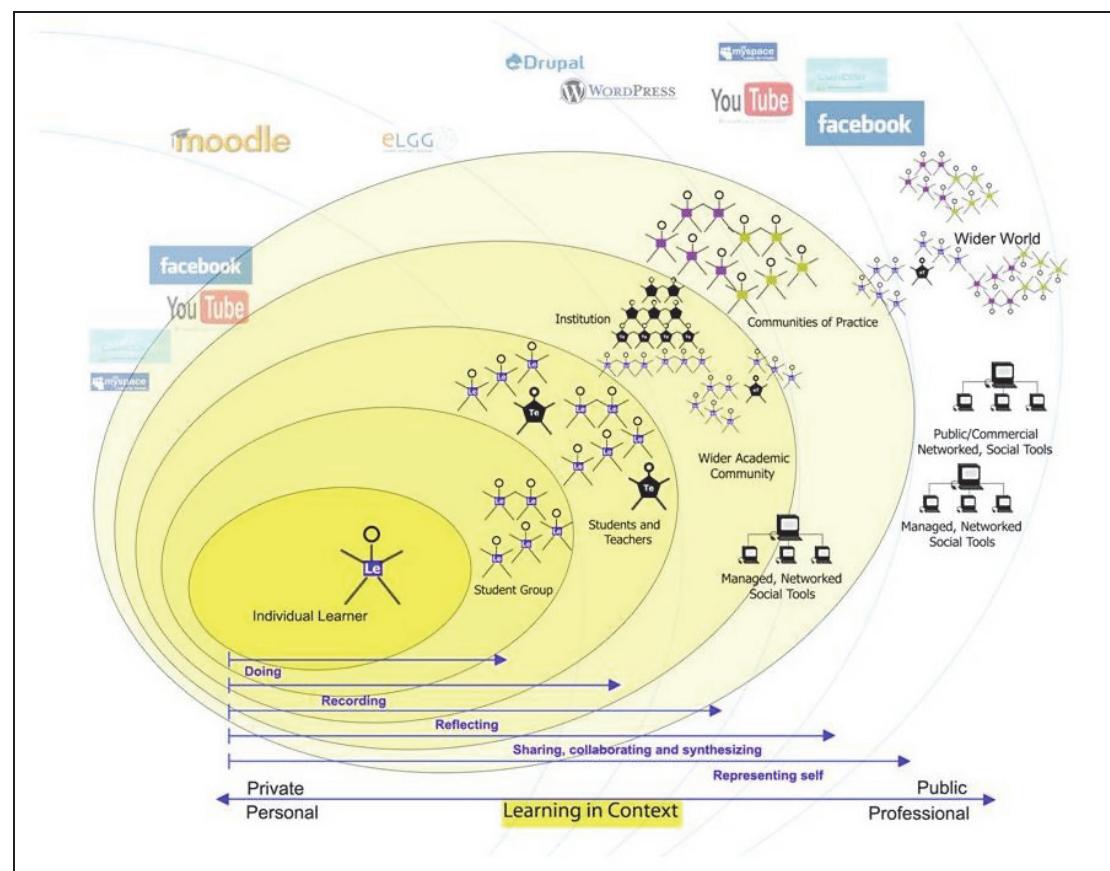
In regard to “*The University and the Social Web Challenge*” section [*ibid.*], the authors examine the implications of “social networking technologies on higher education and the way knowledge” is being taught and learnt. They reported the main challenges of adopting Web 2.0 in higher education, “such as the balance between the conservation of traditional skill and knowledge legacy” and the possibilities that technology “introduces in terms of students’ self expression and construction of knowledge” [*ibid.*], so that Web 2.0 is a participatory Web.

Referring to O'Reilly, the online content must be opened to all users and it should be able to re-use and mash up data as they want and need [as cite in *ibid.*]. Technologically, it is very easy to make Web 2.0 services such as Facebook and Twitter available on-campus and to improve educational services. But the pedagogical justification deserves great attention. This characteristic of Web 2.0 tools is highly in conformity with social *constructivism* of Vygotsky and *constructionism* of Papert. A relevant aspect of current ICT allows students to interact and enable to an active learner. Another relevant concept is a community of practice by [Lave and Wenger, 1998] which enhances students to get, involve and participate actively in a group or community (see also in 3.2.4).

Students can openly share and discuss what they learn and work collaboratively via learning platforms. This achievement is even greater if channels exist through which the students can receive direct commentary on their work via social software like Facebook, Blogger, Hi5 and mySpace. Working and sharing information empower not only individual learning, but also socially collective information within a classroom. Another interesting project, called *Ravensbourne Learner Integration Project*, the researcher argued that a learning environment that is assembled through learner choice [Ravensbourne Learner Integration Project, 2006] [Hall, 2009]. They proposed a learner integration model that focuses upon the individual's transition from private to public learning in the context of social software and communities of practice as illustrated in Figure 4.

Figure 4 : Learner Integration Model

(Source from [Hall, 2009])



According to [Hall, 2009], we have seen the value of Web 2.0 tools that have been used widely either by students or universities in the context of doing, recording, reflecting, collaborating and representing self. To this point, we have seen that the constructionist learning process can be embedded into various tools of *Learner Integration Model*; from individual learner, to group and then extend to wider world. Learning in contexts may originate from personal in private zone and expand to professional in public or social world. We have seen that these emergent technologies may be useful in promoting collaborative learning, giving students information and engaging their learning. To augment this thesis, we seek incorporating technology into making an object-to-think-with in order to find an applicable solution in the context of constructionist learning environment.

4.5. Implication to Constructionist Learning Environment

A teaching typical in many classrooms is frontal style. This is a monologue norm and means of instruction. Most technologies in education have been used to deliver the content and class materials. Teaching by telling can work extremely well by explaining and presenting of information in front of the class [Schwartz and Bransford, 1998].

According to [Hammond and Manfra, 2009], they reported that the teachers deliver information to students when lecture the class and ask students to read more from textbook and other forms of class materials. Dated back to Bruner, he mentioned about the aids to teaching, including not only books but also “films, TV, micro-photographic film, sound recording and the like” [as cited in *ibid.*]. Later work of Harris and Hofer reported the well-known PowerPoint and other slide-ware have been widely embraced to support the class materials [as cited in *ibid.*]. Other examples are live streaming, video-on-demand services, and podcasts which are widely posted on the course website.

According to constructionist learning, the role of teacher is that of a facilitator. The technology is used for students to present the content, and represent their understanding by creating a project and making their understandings visible to the teacher and classmates. It is personal learning by making a meaningful object. Therefore, we should consider not only learner-centered but also focus on project work of learners in the educational setting. Since the instruction meaning-making process is analogous to project-based learning, both the technology and content are an object-to-think-with that may support the dialogue among participants – teachers, students, and tutors in the classroom. This encourages students to engage actively in concept formation.

The ubiquitous computing and tools serve to enhance the technology in education and establish a Learning Network of which people and organizations are created, shared, supported and studied in specific knowledge domains [Kopler and Sloep, 2003]. When we endorsed the Web 2.0 as a participatory web for learning, it is worth to consider what and how to motivate students to participate for their subject learning or how to convince them to get involved in classroom activities. Several researchers suggest implementing a collaborative procedure as well as project-based learning into the class as summarized in the next section.

4.5.1. Collaborative Learning

Collaborative learning deals with a collaborative workgroup in order to solve problems together through conversation and negotiation. Moreover, that manner of learning involves sharing and valuing the perspective of others. To support this process the environment should contain tools for shared communication, tools for collaborative work, a resource base, and a repository of information. As suggested in the Learning Webs concept, the learners shall share their knowledge and even search the available expertise via their preferred networked learning environment.

The practice of “collaborative learning provides an environment to enliven and enrich the learning process” [Kumar, 1996]. It connects interactive stakeholders – teachers, students and tutors – into an educational system and “creates more realistic social contexts, thereby increasing the effectiveness of the learning [system]” [ibid.].

According to [Stahl et al., 2006], they studied on *Computer-Supported Collaborative Learning (CSCL)* and explained “collaborative learning involves the making of meaning in the context of joint activity”. The learners must interact and participate in the learning context. Related to chapter 2, collaborative learning is a cognitive strategy based on the social construction of knowledge which leads people to a deeper processing and understanding than other types of learning approaches. Saltiel defines collaborative as organizational or individual entities coming together to work towards a common goal or vision. In collaborative learning, the goal is the acquisition or construction of new knowledge [Saltiel, 1998]. Thus, engaging students in project-based learning has been recognized as a powerful method to motivate learners. Furthermore, several research groups focus on the concept of social interactions and knowledge sharing environments [FLE, 2004] [CSCL, 2006] [Sulthurs, 1999]. However, the constructionist environment has experimental results conducted by [Ostwald, 1996] to observe the knowledge construction process in the context of software development, specifically in the participatory design process.

Work from the L3 research group recommended that collaborative learning can enhance peer interaction and work in groups; thereby, facilitating the sharing and distribution of knowledge and expertise among community members [L3, 2006]. According to [Ostwald, 1996], he related his research work called the knowledge construction process with the constructionist methodology. In knowledge construction, learners bring pre-knowledge and some experiences to the class. A Model of Knowledge Construction consists of artifacts and understanding. Both components are two dimensions of knowledge. Knowledge construction occurs when artifacts and understanding co-evolve via representation and interpretation. Moreover, he extended his model to the collaborative domain. He proposed a model of collaborative knowledge construction. In this model, the communication between participants took place around representations that becomes part of the shared context. It is tacit. Then, new knowledge can iteratively be built on existing knowledge. This recursive process can be exploited into the design process of the learning environment.

To summarize, the key knowledge construction is *activation-communication-envisioning* cycle. Such process can enable mutual understanding of new learning practices within the desired learning environment, as explained by [Ostwald, 1996].

We experimented and tested the above process with our case studies. In the design and development of a learning environment, we encouraged learners to construct their comfortable environment by first engaging in a continuous dialogue among class members. This recursive discussion is designed to initiate a new agreement on the desired learning environment. To collaboratively create a ideal learning platform, the research methodology and design experiment are explained in more detail in Chapter 5 which include why we propose such a process, why we suggest allowing students to create the tools themselves, how we design the process, and how students participate in the design process during the class.

4.5.2. Computer Supported Collaborative Learning

As discussed in the CSCL research community, collaborative technologies are a powerful way to construct the communal ways of seeing, acting, and knowing [CSCL, 2006]. These technologies can make a setting for collaboration or directly participate in the production of shared knowledge [Roschelle, 1999]. In collaborative learning, Fischer argued that the freedom of students within the computational environment does not necessarily guarantee or systematically produce a learning outcome [Fischer, 2001]. This direction has been shared among other researchers in computer supported collaborative learning regarding scripting strategies of interaction in CSCL [CSCL, 2006]. Therefore, we need a set of collaboration step, including know-how and know-what to do in learning environment. Consequently, the CSCL researchers have promoted collaborative learning through digital media technology for decades based on the meaningful learning theories. This causes the flexibility and openness for learners to trigger either peer-to-peer or self-governing learning environment [Chen, 2001] [Sugrue, 2000].

Digital technology and networking service has opened the possibilities of applying the theory of collaboration. The advancement of digital technology shows great potential for changing the way students and instructors interact in the learning processes. CSCL researchers have shown how different tools and formats impact social interaction and learning [CSCL, 2006]. According to [Bonk and Cunningham, 1998], a survey on collaborative technologies including their own work can be summarized in five levels of online collaboration by the level of complexity: the first level, asynchronous messaging systems and e-mail; the second level, asynchronous conferencing tools; the third level, real-time brainstorming; the fourth level, real-time document sharing and editing; and the fifth level, highly sophisticated cooperative hypermedia. These levels provide multiple forms of collaboration.

The Computer Supported Intentional learning Environment (CSILE) and Future Learning Environment (FLE) have been designed and developed in order to realize and demonstrate that inspiration. CSILE is a network system to provide across-the-curriculum support for collaborative learning and inquiry [Scardamalia, 2003]. All students on the network can read the discussion thread and write comment to that forum. In 1997, it released a knowledge forum function. This function is a component-based knowledge-building environment designed to support problem definition and hypothesizing, the collection and analysis of information, and collaboration in the classroom. The focus of CSILE and the Knowledge Forum is to examine new ways to design the classroom environment and harness technologies to support educationally productive processes.

Similarly, in this thesis we propose the concept of *Constructing the Learning Environment* (chapter 6) to provide friendly tools to use in a less formal learning environment and to motivate students using the platform regularly to share ideas with others. The tools are selected and agreed to deploy by students. They can, therefore, easily and quickly support the social atmosphere in a classroom process.

4.5.3. Connectionism and Connectivism

Through the Web 2.0 and social software tools, we may reinforce the learning community and foster a relationship between learning and the whole learning society. This community is inter-networked and linked altogether. Indeed, students are connected and share all the information while involved in an internet-based learning platform. Recently another network educational framework called *Connectivism* [Siemens, 2004]; based on the theoretical framework of *Connectionism* [Rumelhart and McClelland, 1986]

According to [Simões and Gouveia, 2008], they argued that *Connectionism* theory can effectively simplify: “distributed cognition at the individual level”; on the other hand, *Connectivism* perspective can efficiently refine: “how knowledge can be distributed through networks of people and appliances” such as a database, community, and network.

According to [Siemens, 2004], he simplified the principles of connectivism that “learning is a process of connecting specialized nodes or information sources” and “needed to facilitate continual learning”. As a consequence, learners have the ability to see connections between fields, ideas, and concepts, when they individually participate as a node on a network that learns. Siemens explained that connectivism is a learning ecology which is focused on connecting specialized information sets, and the connections that enable us to learn more are more important than our current state of knowing as shown in Figure 5. Probably, that connectivist model of learning may fit well with the Web 2.0 concept that could lead to bind VLE and PLE into the learning platform for learner in digital knowledge space as sketched Figure 6.

Therefore, learning in a connected world and a learning web, referring to Piaget, Papert, Vygotsky and Illich in the former chapters, emphasizes the social nature of learning, especially in the case where learners are learning and helping each other. Indeed, the dynamic communities and information exchange in social networks may consider creating a learning society. Next section we explore how we connect students into social software and encourage them to engage in their learning.

Figure 5 : Connectivism: Process of Creating Network
(Source from [Siemens, 2004])

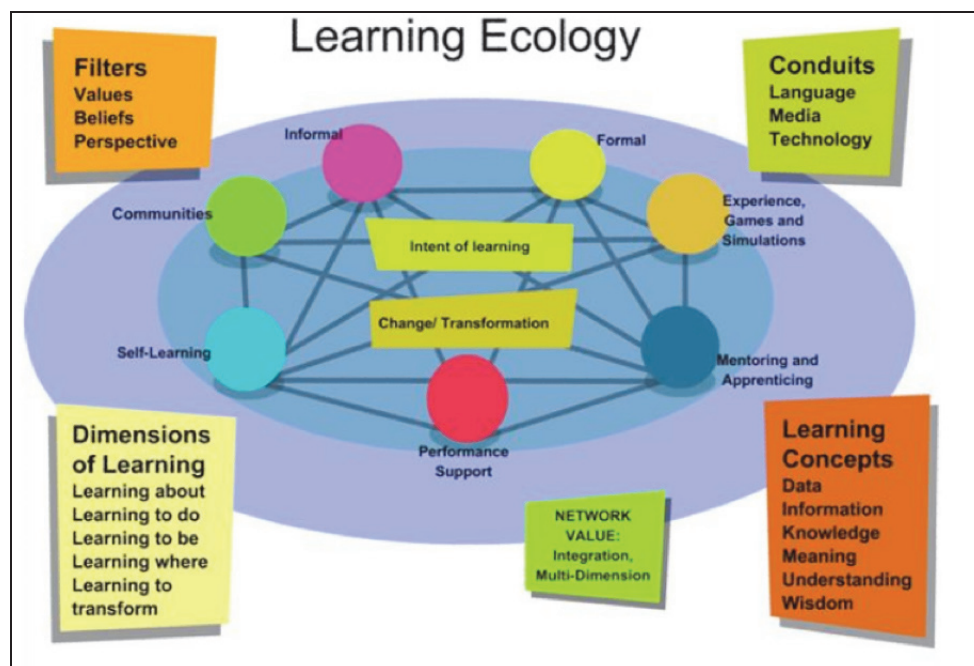
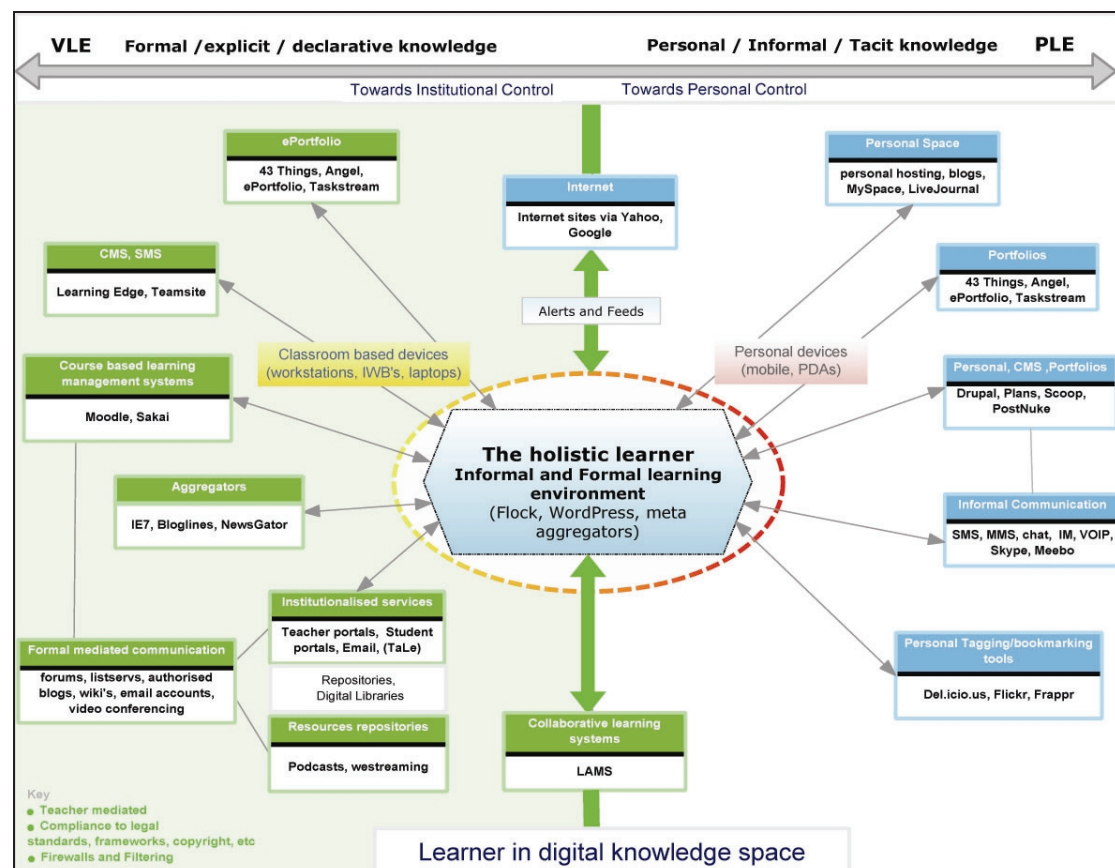


Figure 6 : Learner in Digital Knowledge Space
(Source from [<http://thand.wordpress.com/category/ple/>])



4.5.4. Engaging Learning and Social Networking Technologies

How to engage students in the learning setting referred to the former section and how to balance and integrate the engagement in learning are our concerns. Some educators think of the engagement from a different perspective as can be summarized in four categories:

“The most fundamental is student engagement with the learning process: just getting students actively involved. The second is student engagement with the object of study ... by direct experience of something new. Another is student engagement with contexts of the subject of study. ... Finally, there is student engagement with the human condition, especially in its social, cultural, and civic dimensions. [Bowen, 2005, 4]”

According to Bowen, such engagements have been paired and implemented to various learning: active learning, experiential learning, multidisciplinary learning and service learning [ibid.]. Alternatively, in practicing so, teachers may involve themselves in using ICT tools, and integrate Web 2.0 tools in their learning and teaching process, rather than just use technology in conventional way. The benefit of using a given technology in teaching and learning only comes about when the holistic view is adopted. Therefore, students may engage in social activities or communication during the class. The Web 2.0 and social software tools can well support this kind of interaction. These enhance the participatory, dynamic, and collaborative processes via the computing tools. The most important contribution of engagement is the focus it brings to the learner's personal relationship to personal learning.

In order to benefit from these networking tools in Higher Education, the open architecture of ICT systems must be deployed and the students should have opportunities to use Web 2.0 and social software tools in the classroom intuitively. Simões and Gouveia recommended that Web 2.0 services and social networking technologies give the power to group learning and the services give an opportunity to interlink “between life, work and school, thus creating meaningful educational experiences” [Simões and Gouveia, 2008].

This chance may create a potential for a self-constructed learning environment and provide a student-centered pedagogy in engaging a dynamic learning setting within the campus. In view of the fact that teaching and learning are different, accordingly a focus on the learning of learner is essential to the improvement of student engagement and of teacher teaching in higher education.

4.5.5. Constructionist Learning and Platform in Higher Education

On the use of computers in education, we presented in chapter 3 that a combination of several theoretical framework has been employed. Most of work we mentioned is interdisciplinary research such as FLE, CSCL, Knowledge Construction, Mutual Understanding, Conectivism, and Social Network Analysis. The researchers embedded their methods into the curriculum and presented how to apply these frameworks to action. In this section we explore the previous works and further extend their research direction to our research in the deployment of technology into the learning environment.

We also found prospective state-of-the-art technologies and witnessed a possible way to deploy those tools into higher education. Effective learning in higher education may need to be semi-structured, scripted the collaborative step and well-planned learning experiences in order to motivate active learning atmosphere and provide a challenging learning environment. Some of tools are popular among students, especially social software. Students are using such tools not only to share personal information, but also in classroom learning. Perhaps reflecting on the information selected is essential to create ideas and knowledge [Lai, 1999]. Based on social network software, we see the relationship of learners and their learning webs that might enhance and should embrace into constructionist learning in higher education.

To design a constructionist-learning environment, the students should be encouraged to understand and think about their learning process. We will show in case studies of chapter 5 that students have to be able to select the information needed, organize it into a structure, and link it to their existing knowledge structure so that it can be used to solve problems in other settings.

In constructionist learning, the students are encouraged to understand and think about their learning process. We will show in our case studies of chapter 5 that students have to be able to select the information needed, organize it into a structure, and link it to their existing knowledge structure so that the knowledge can be used to solve problems in other settings. Connecting information into structures and giving it personal meaning is an individual as well as a social process that requires a great amount of reflection.

We correlate the usage of the technological platform to the practical teaching and learning. This is not easy to accomplish, especially to employ a loosely controlled environment or even less constrained environment in order to gain more interactions and participation among teachers, tutors and students. This is our innovative attempt to bring constructionist learning into the higher education context.

To conclude, in this chapter we first examined the academic teaching and learning, and then mapped the learning theory onto pedagogical approaches. We explored to choose the learning and teaching activities that stand a good chance of allowing the students to gain knowledge and achieve learning in a higher education context. To empower the learner is to build their understanding of subject matters. Thus, our approach focuses on what activities individual learners are doing and collaboratively interacting in a social environment. Subsequently, we foresee the ICT learning environment and its design framework that shall be a direction for deployment for technology-enhanced learning. In this research, we present the constructionist educational practices on how to deploy the technological learning environment into the university level. We also explain how to support students with the constructionist learning process. In the next chapter, we investigate our research problem in a case study research and present the results for constructing the learning platform in classroom.

CONCLUSION: FOUNDATION SECTIONS

What do former chapters namely 2-4 and aforementioned theories mean for the research? Why and how we integrate those theories into technologies and inject them into research design experiment?

Understanding educational philosophy is a must, for the design of a suitable computing system for higher education. In the former three chapters, relevant educational philosophies were reviewed as guidelines for educational technology designing. Concepts of higher education were studied and surveyed to establish the linkage of fitting convivial tools with the interactive, collaborative and personal learning environment.

Research experiments were designed based on the frameworks shown in chapters two, three and four, to show how technology can be developed to enhance the learning environment. Top of all were Papert's *Constructionism* and Illich's *Conviviality*. *Constructionism* and *Conviviality* concepts are applied in several technology-related researches and experiments (see Section 3.3 and 3.4). Pedagogical meanings and perspectives on constructionist "object-to-think-with" was also incorporated into our experiment shown in later chapters (see Section 5.1.1), to show how learning can be enhanced in a university's technologically-rich environment with the effective use of tools in classroom. Constructivists and constructionists believe that personal experiences can help in building knowledge. Such learning can be obtained through formal and informal approaches. Technologically, constructionist environment and convivial tools can be applied to turn students into active learners via hands-on project or project-based learning.

From the encyclopaedia of higher education (see chapter 4.1), to design a technological platform for higher education, learning communities can be developed with the right tools to increase academic competency and social interaction.

Our research experiment required students' collaboration in sharing ideas and artifacts. Under the designed learning platform, we encouraged students to create a visible design with object-to-think-with notion. The project-based learning and student-centered model in turn created social interaction in both virtual and face-to-face environment. Students' personal learning and interaction was supported by ICT.

Guided by the constructivist and constructionist learning models, aside from classroom learning, learning could be more effective in the environment that students were allowed to participate, negotiate, communicate and share knowledge. Students in our experiment were encouraged to share their perspectives and learn from each other via a particular technological platform.

ICT such as Web 2.0 technologies, wireless networking and MLE, can be incorporated into the constructionist learning environment and convivial computer tools, to maintain students' enthusiastic participation in and out of classroom. At universities, some tools exist, but with multifunction. Yet, it can be applied as convivial computer tools, if deployed to promote classroom creative process (see Section 3.4.1 and 3.4.2). Digital technology can also be a supplementary tool in experiential learning, namely doing-feeling-watching-thinking process, and constructively help augment a process of individual transformation (see Figure 2 and Figure 3).

Our experiment was designed to create learning awareness and responsibility through active involvement by students. Through MLE, learning space was provided for our case studies (see Chapters 5 and 6). Exploring technology in education renders understanding in non-operational and well-run instructional concepts in classroom. The survey of previous and existing technologies exposed successes and failures of educational tools in schools and universities, which were used mainly as instructional tools to transmit information from teachers to students. Our research is to show how these technological tools could be used to improve the learning environment.

Effective learning could be assured if technology through the constructionist learning process is used to transform subject matters to meaningful knowledge. Learning tools can be enhanced to promote an active participation from students. This thesis is meant to show the positive outcome from the use of digital media in learning process. Such is permitted by the internetworking and interactive learning environment, which enables social activities across the world. Pervasive technologies like mobile and ubiquitous computing can also facilitate learning as well as connect students to the learning, regardless of time and their locations. Binding Constructionism, Learning Webs and Tools for Conviviality together is equivalent to the hand-head-heart authentic learning concept. Together, students can learn and organize their own learning and thinking in a user-friendly environment.

With a variety of tools that enhance group interaction, education can be more enjoyable. Our case studies found that learning contains no boundary if students were given an opportunity to engage with two-way communications through Web 2.0 applications and other social software concepts. Incorporating the software in education platform may help enhance their understanding, as subject matters were studied and debated extensively in and out of class. Passive learning under conventional method, as shown in Chapters 2-4, proved ineffective. The environment can be improved, as shown in our experiments, when students are engaged with subject matters and share their learning through electronic tools. The sharing of learning content is possible thanks to the Internet technology. With collaborative tools, the learning was extended outside the class (see Section 3.6.1).

Convivial tools can enhance learning, but each should be applied in the learning process with an explicit objective. As universities worldwide are deploying ICT in higher education, our design experiment in the later chapters may give an insight on how to make the full use from digital tools available.

As Chapters 2-4 pointed out, a successful constructionist-learning environment can be created if teachers and students are engaged in the teaching and learning method. In class or via the electronic platform, students are expected to reflect their own understanding of subject matters and actively engaged in questioning and answering throughout a course, if we are to create an interactive and collaborative environment. Such procedures were applied in our experiments, which will be shown in the next chapters. On the next pages are our design experiment and empirical research to prove our hypothesis and convey the research questions. We will investigate the impact of technology on higher education as well as the design aspect of constructionist learning environment and convivial digital tools. As students' interaction and collaboration in class and on electronic learning platform is observed, our mission is to see how effective the learning could be under the convivial environment.

5. CASE STUDIES AND EXPERIMENTS

This chapter presents the experiments of this work and explains the electronic learning platform at the University of Bremen. As noted earlier, we designed the case studies and experiment based on our understanding of aforementioned theory and practices. The case studies offer evidences of the importance of learning environment designs in the complex architecture of technology-enhanced learning in higher education.

Nevertheless, the main goal of experiment is to examine the constructing process of the learning environment based on our research questions and to prove our hypothesis based on the evidences about learning settings. We hope the findings may possibly offer us a guideline and solutions for designing the convivial technology in higher education. The theoretical frameworks from previous chapters are transformed into learning activities as presented in the case studies. We experimented on the computational learning environment in higher education and sought out how to conjure convivial environment. Focus is placed on the investigation of the software complexity and diverse platform employed at University Bremen.

A feasibility study was conducted to find the possible computer-supported learning platform in each experiment. We surveyed and collected the information of existing system then researched empirically through experimentation during the past years whereby class process and in-class dialogue was observed. In section 5.1, educational practices and the empirical research of the experiment are shown. Next, in section 5.2, we propose classroom procedures: activities, approaches and frameworks. In section 5.3 and 5.4, we describe the case studies: the course description, the objective and outcomes of each project. In the last section, we present the conclusive evidences and results.

5.1. Empirical Research: Blending Educational Practices

Case studies concerned primarily with empirical research methodology. Educational practices are constructed and collective experience of the class experiment is studied. Through this, we aim to explore and confirm the theoretical concepts that foster understanding.

5.1.1. Constructionism: From Philosophy to Practices

The presumption of this work is a constructionist approach: what students are doing within the technological-rich learning platform. The learning and activities in classroom and outside are the heart of the experiment process. Case studies are aligned with the education framework from Chapters 2 and 3, in the higher education context as explained in Chapter 4.

In constructionist perspective, learners should be able to apply their knowledge in their real life. This work is designed to find the relationship between learning in education environment and the treatment in authentic learning.

In higher education, learning theories are applied to learning and teaching process. In these case studies under constructionist theory, choices of technology are important. To examine the influence of emerging digital technology, we combined the

constructionist theory into the higher education context. The goal of this constructionist-learning model is to give students the opportunities to become active designers, creators and users of digital technological tools, not just passive users. Constructionism affirms that knowledge can be constructed especially in the context that allows learners to design and build meaningful artifacts or projects. Teachers guide learners in discussions to come up with their own projects and explore their own interests within the given context. Teachers and learners can become the designers of class contents through different technological tools as well.

Educational Practices

We assumed that constructionist-learning process influences the use of LMS or CMS platform in the experiments. According to the experiences at the future of learning group²⁴, the classroom experiment in this work is empirically based on the following constructionist principles as shown in Table 2.

²⁴ The Future of Learning Group, MIT Media Laboratory: <http://learning.media.mit.edu/>

Table 2 : Constructionist Principle in Classroom

Constructionist principles	Classroom Process
To focus on constructionist activities	Encouraging students to work as designers as well as users
To encourage students to work on projects	Empowering students to find their own requirements and interests
To create a sense of community	Networking students work together with one another and with support and inspiration from each others
To provide resources and opportunities	Connecting students to work and share into network

Constructionism allows learners to come up with different learning environment. Papert's constructionist process shows that existing computer technology can be used to create radically new ways of learning by [Papert, 1990]:

- Giving students greater control over the learning process.
- Making the learning of all subjects more personal and meaningful to learners, so they are more motivated and the learning is more effective.
- Extending the content of what is learned to include the study of computer and other social technologies.

In the experiment, we designed the classroom process as a project-based learning. Aimed at learning by doing, we emphasized on a collaborative project. Students were assigned to design their personal and desirable learning environment. The new learning environment should drive them towards a new way of thinking and the active process should lead to new understanding.

Indeed, we considered the project as an object-to-think-with and as tools to be studied and understood by students, rather than a teacher's instruction. This is the essence of the constructivist and constructionist approach, whereby activity is the central point.

In designing classroom experiment, we monitored our case studies and analysis based on framework of [Sawyer, 2006]; we need to keep in mind the following inquiries:

- How does learning happen?
- How do different learning environments contribute to learning, and how can we improve the design of learning environments to enhance learning?
- How much support students need, from the teacher, computer software, or from other students?
- How can we create an atmosphere where students feel like a learning community?

All case studies contained regular face-to-face meetings. Class participants met periodically to discuss, assess and share their ideas on the class project. In the next section, we explain in detail the classroom procedures: how we conducted the experiment and set up activities.

5.1.2. Class Project: The Role of Technology and The Powerful Idea

We planned the experiment as a project-based course and emphasized on learning-by-doing, specifically learning-by-making, so that students got to think and learn together. Students were encouraged to exchange ideas during the class, as this project was an object-to-think-with. We provided a networked environment or electronic learning environment, like LMS or Course Portal, and eventually encouraged students to use it for their group work, social interaction and knowledge sharing out of class. Students were assigned a group work to collaboratively design the learning platform. They had to analyze, synthesize and design a final product for their preferred computational environment with the co-constructive process. We conducted debates and students were encouraged to resort to online discussions and get interactive throughout the semester. As this required collaboration from all, a channel is necessary to keep all students connected even after class.

To ensure course material delivery, the information management and the idea exchange, a communication platform was set up. Students were required to present the task progress and sample prototype that supported design development. They were required to engage in co-constructive interaction and discussion in class to substantiate their points of view. The dialogue was long enough to construct a deeper understanding, that together they could achieve more.

In this experiment, lecturers monitored online discussions and make suggestions when discussions were inactive. To improve students' learning, they guided students towards alternative views, enhance their argument skills and help them clarify their own idea during the face-to-face discussion. We persuaded students to think out-of-the-box and to understand their learning ability. This is an alternative to traditional didactic approaches. Most lecturers in higher education should have new perspectives on the teaching and learning process within technologically rich environment.

5.1.3. Classroom Environment and Course Settings

In case studies, we started the class with introducing informal idea about constructionist learning in order to motivate students to think about their learning and to find the way to engage with the technology convivially. After starting discuss about their project work, we challenged them to work on content exchange and development.

For each case, there was a course website where all – students, tutors and lecturers – used to manage the course. Discussion on appropriate learning environment is the initial process of co-construction learning platform. In particular, we shared idea on technologies that can be deployed such as LMS, CMS, social networking software and so on. Students also shared their hands-on experiences after a few weeks of project work. Later, students explored the functionality and applicability of the available technology. Then they created a forum and set up a discussion via the installed learning platform. Weekly, students presented their project work and met face-to-face in order to exchange ideas and listen to others' views.

5.1.4. Data Collection

In getting more understanding, the empirical study and ethnographic research were used. The data was collected through the observation to describe how and what students collaborated in particular settings. We conducted the experiments on different courses in different semesters with different groups of students.

The researcher spent a considerable time on observing and analyzing how students actually worked and learned together via computer-mediated system during the courses. To understand the role of social-interaction and campus-atmosphere influences on students, we observed the student interaction both in physical classroom and through the virtual environment during the course. Meanwhile, we did an axiomatic review and studied various scenarios of other research papers [FLE, 2004] [CSCL, 2006] [Chapman, 2006] [Sipitakiat, 2007] to find examples and evidences on how we can construct the learning environment in real situation. We examined the ways students co-constructed their understanding of the effective learning environment through the course content and project-based experiment. The empirical process has been used in this data collection. We conducted a semi-structured interview with students during the classroom process as well as exchanged conversation and dialogical communication. Moreover, we observed the activities occurring throughout the physical classroom, students' message in discussion forum, their interactions, and their engagement in technologically rich environment during semester.

We perceived that an electronic learning space allowed students to further access to presentations from other Internet resources or those posted by other students. For that reason we allocated a common website for the class members to access learning materials, post the project presentations, submit assignments, inquiry information, ask and answer questions. Yet, the technology was used in relation to course materials, social aspects, and communication tools.

According to [Bers and Urrea, 2000], they proposed, "Constructionist learning experiences cannot be evaluated with traditional techniques". Consideration is focused on the processes of learning rather than pre-established educational outcomes and curriculum objectives. Accordingly, we entailed the productive way of documentation, assessment and observation through discussion forum, idea exchange in classroom, class presentation and so on. During the classroom process, we observed the activities both face-to-face in classroom and communication exchanges via computational learning environment in order to determine the following impacts of constructionist approach:

- The dialogue on tools idea sharing
- The ways students share project design
- The involvement in learning environment
- The role students in the learning community

To sum up, we collected all the documents such as class photos, log-files, discussion forum, files sharing and other digital content from the learning environment.

5.1.5. Data Analysis

In the experiment, we organized a proactive discussion at the beginning of the course and persuaded students to practice dialogue and feedback process in the class. We eventually expected students to give feedback on the forum or chat room. We analyzed the class discussions and other data collection from the digital platform such as forum, chat and file exchanges, then interpreted and explained what we found. We applied the data analysis of constructionist research approaches and continued iteratively observed the recursive manners as depicted in Table 3, according to [Urrea, 2004]:

Table 3 : Data Analysis and Observations

Data Analysis	Observations
Student engagement	<ul style="list-style-type: none">• Student motivation and readiness• Participate to the class project• Design, construct, modify and share ideas• Imagine, express and realize their ideas• Share projects with others
Relationship with community	<ul style="list-style-type: none">• Collaboration and interaction• Join out-of-university learning at a room-lab• Exchange the ideas via the learning platform
Technology use	<ul style="list-style-type: none">• Environment and opinion• Effective• Convivial• Frequency• Meaningful• Support

In all courses, the course outline or syllabus was presented to the class. Class procedure and importance of using computational learning tools was explained. All students, tutors and instructors were asked to share ideas and comment via any communication tool or discussion forum. Since the lecturer performed as a researcher, we set the clear goals in mind and kept observing on the following thesis questions:

1. How should educational tools look like to become convivial tools for higher education in order to enhance an interactive, collaborative, and personal learning environment?
2. How can electronic learning environments in higher education been used in order to raise awareness for the learning process and to foster constructionist learning?
3. How will participants — students, teachers, and tutors — be encouraged to effectively interact with each other? How will they network and share common classroom activities?
4. What procedures are needed to ensure the effective use of tools in a classroom and how to organize these tools to fit, but not to force, a student's use?

For the time being we also recapped the similar questions to students and encouraged them to regularly use the assigned learning platform. In next section we explain more details about the classroom procedures, frameworks, activities and approaches regarding the design experiment of all cases.

5.2. Classroom Procedures: Activities and Approaches

In the experiments, students were put in small groups, first appearing informal, to facilitate free flows of discussion. The lectures were informal, though the clear framework was precisely set. Within the framework, students were encouraged to develop ideas while content discussion depended upon class materials.

According to [Griffiths et al., 2002], they affirmed that the process of building and managing groups could develop teamwork and interpersonal communication skills. Development of these group work and other skills may foster conditions whereby students can observe their own learning styles, change these styles to suit different tasks and engage more deeply with the content of their subject. In groups, our students were presented the fundamental understanding about learning: learning is an environment, an activity and a tool to achieve understanding and social involvement. We consider how the framework in each case study can alternatively contribute to the design experiment in various learning environments and courses of this research.

5.2.1. Learning Space: Physical Learning Environment

To accommodate the technology and the new approaches for learning, the physical environment should be convivial. Thus we transformed the classroom into an atmosphere that fosters collaboration and openness. The layout was set in the way to promote brainstorming and idea exchange. It should be a functional setting, which can be easily customized to fit specific activities. Digital technologies and other resources will be accessible to students at all times.

Discussion in the class and after should be facilitated.

Moreover, the students would need ongoing facilitation to work in groups during the discussion inside the class as well as outside via learning platform [Griffiths et al., 2002]. Furthermore, Griffiths and Partington affirmed that it is possible to arrange a room to achieve certain desired effects; for instance, nervous students can participate more actively if having direct eye contact to other students or lecturer. The level of student participation and student-student interaction can be affected by the seating patterns. Seat arrangement can affect interaction within group [Griffiths and Partington, 1992].

Classroom setting is essential in terms of participation and interaction. Evidence shows physical arrangements have a powerful effect on interaction in classroom [Korda, 1976]. At Digital Media in Education research group (in Germany is Digitale Medien in der Bildung - DiMeB), we designed the same atmosphere for the research lab and research room. We allocated learning space for students and decorated room casually for students who came to work on their project. We found that it enhanced their interactive learning and working [Schelhowe, 2002] [Schelhowe, 2007].

Accordingly, in our class lecture, students were required to move around the room for small group discussion, to enhance interaction, communication and collaboration.

5.2.2. Learning Space: Networked Learning Environment

Networked Learning Environment (NLE) or Virtual Learning Environment (VLE) is basic infrastructure of ICT. The learning platform installed in campuses allows learners and teachers to read and type comments, post questions, share feelings and plan their study [Pettit and Mason, 2003]. Though virtual, it can be a real campus. Sometimes, VLE is used interchangeably to Managed Learning Environment (MLE). An educational report explains while VLE offers space for student work, alone or in group and sometimes with their teachers, MLE that includes VLE is a bigger system and covers administrative task such as register system, course input, data management, enrolment and so on [JISC, 2001]. VLE has evolved from a web page that contains material slides, hyperlinks, assignment and maybe bulletin board. In higher education, it can be a stage of exchanges for participants. It also has many features similar to those used in various universities around the world (see more examples in chapter 3).

The networked learning environment mainly aims to offer an online access to information, course material and academic knowledge, according to [Scardamalia and Bereiter, 1994] [OCW, 2009]. In fact, the internetworking environments provide students the worldwide resources and serve as a communication channel for students to conduct their research in a collaborative way and engage them in critical debate. Students connected to the Internet can create their learning network, encouraging Siemens to come up with the Connectivism term (see Figure 5 and Figure 6).

Most of networked learning researches are aimed at studying the characteristics of a collaborative learning community. In this work, the focus is on the characteristics of social networking community, precisely how underlying social learning influence the constructionist approach.

5.2.3. Class Reflection: Dialogue Process

Group process and dialogue in the class

In our experiment, the classroom had 15-25 students per course and they involved in project work design, learning management platform and re-design or re-think a new and comfortable learning environment. We expected students to realize how groups function, understand openness of spirit, accommodate different views, access new ideas and manage a group work, according to [Griffiths et al., 2002].

Dialogue and Feedback Process

We promoted communication in classroom and found that communication like listening, asking and answering questions and responding, played a great role in our teaching and learning setting. The dialogue in the classroom and the interaction skills could support the reflection of the learning process.

Class Reflection

In experiments, we adopted various techniques in working, discussing, teaching and learning within a classroom. The methods in Table 4 have been employed to enhance the interaction [Habeshaw et al., 1992].

Table 4 : Classroom Methods

Methods	Descriptions
Brainstorm session	Exchanging general ideas from the group
Buzz group	Two or three people are asked to discuss and issue for a few minutes, then comments are usually shared with a larger group.
Free Discussion	Topic and direction comes from the group
Peer tutoring	Students learn from one another and teach one another
Role-play	Use of allocated or self-created roles, such as user and developer roles
Syndicate	Involving mini-project work, followed by reporting and presenting to the full class

Class Reflection: Feedback Process

Additionally, learning was promoted through feedback. Students responded to problems or ideas and received feedback. They returned their feedback via online discussion forum. Attention to the issue means they were involved in the process of comprehension, analysis, synthesis and evaluation [Gibbs, 1992] [Brown and Race, 2002].

Listening attentively to individual students in the group and to the group's mood will heighten the ability to respond and give feedback. The more intense listening is, the more likely that students learn how to respond and when to respond and in what ways, either in-class or on-line.

Aside, we asked students to maintain a diary as well as records of meetings, discussion and particular tasks. Before presentation, they were required to submit a summary report. Also, in one-block lecture, it was sometimes structured as follows:

- Group presentation
- Listening group presentation
- Questions and discussion
- Summary

Student: Engaging in Learning

In regard to project-based experiment, the participatory design serves as an activity and educational medium that engage learners as active participants and make contextual connections to the knowledge they gain [Participatory Design, 2004]. Working on design activities within a supportive community environment provides the additional benefit of adding the learners' reflection through sharing and discussion. Thus the electronic learning environment and tools plays an incorporated role in supporting such learning.

In our experiment, we applied the engaging learning environment and pedagogical principles into classroom practices. We adopted the following characteristics of engaging learning environment [Means et al., 1993] into the classroom process and the learning atmosphere.

- Students are engaged in authentic and multidisciplinary tasks
- Student participation is interactive
- Student work is collaborative
- Students are grouped heterogeneously
- Students learn through exploration
- The teacher is facilitator

Teacher: Teaching Styles in Classroom

In class, we precisely presented students the constructionist principles and partially instructional principles [Savery and Duffy, 2001]. The techniques were combined with teaching styles [Entwistle, 1988] and they were executed through the following classroom teaching approaches:

- Anchor all learning activities
- Think about learner's ownership
- Design an authentic task to reflect the desired learning environment
- Encourage testing ideas against alternative views and alternative contexts

- Provide opportunity for students to reflect themselves on the learning
- Challenge students to move beyond existing knowledge
- Foster creativity by introducing new resources and activities
- Encourage students' personal expression and imagination
- Promote cooperative tasks and interactive communication
- Create an unstructured and friendly learning atmosphere
- Emphasize practical learning and project-based learning

Lecturing for learning

In higher education, efficient lectures need structured and well-planned learning experiences that encourage students an active role with a interactive learning environment. Though, it is not easy to teach in a less controlled environment. The teachers' perspective must be geared towards a more interactive approach as well as step-by-step change for both teachers and students. Reflection from both sides is necessary. Subsequently, we designed our experiment and lecture scaffold based on the following frameworks [Brown and Atkin, 1988] [Gibbs, 1992] [Brown and Race, 2002]:

- Structure the lecture to warm-up the class and show students an outline
- Show students aims, objectives, learning outcomes and education intent
- Present and cover not too much content on lecture, but enough materials
- Organize lecture and take a break around 10-15 minutes on demands
- Make lectures more participatory and adopt this approach from the beginning
- As the lecture proceeds, continue to show students the lecture outline
- Provide a summary of the main points as completing each section
- Remind students at the beginning of next lecture
- Give students a opportunity to interact as soon as possible
- Assign homework or group work in order to encourage them interact
- Publish full lecture notes and handouts on the course websites or LMS
- Give students a question to be talked both individual and in a group
- Ask student to discuss briefly in groups during class and on MLE
- Assign a project work to encourage them to solve the problem collectively
- Turn a part of the lecture into a question and answer, not only frontal teaching

Horgen reported that students finally perceived the lectures as an active example of learning and information processing that, in turn, helped them digest the material on their own. This motivates students to attend class. To enhance students' concentration in class, we used the lecture techniques identified partly by Horgen as follows: (1) Show syllabus and "use of outlines and list"; (2) "Delivery paced to allow note-taking"; (3) "Pauses to allow clarification"; (4) "Short intermissions for review of material, personal reactions and questions"; (5) Repetition of the main points and (6) "Final recap of the key points" [Horgen, 2003, 89].

According to Paloff and Pratt [Paloff and Pratt, 1999], we also blended the face-to-face activities into the online MLE for our course experiment as depicted in Table 5.

Table 5 : Classroom Approach: Face-To-Face and Online

Activity	In face-to-face class	In learning environment
Preparation	<ul style="list-style-type: none"> • Review assigned reading • Review lecture materials • Review and prepare in-class activities 	<ul style="list-style-type: none"> • Review assigned reading • Prepare discussion questions and lecture materials in the form of a paragraph or two
Class time	<ul style="list-style-type: none"> • Dialogue on subject matter • Exchange project idea 	<ul style="list-style-type: none"> • Read students posts • Respond to student posts
Follow-up	<ul style="list-style-type: none"> • Individual contact with students • Reading students assignments 	<ul style="list-style-type: none"> • Individual contact with students via email and discussion forum • Reading students assignments

In the following sections, we examine how students design and build computational platform that can promote their constructionist learning and guide them how to learn meaningfully. We investigated students' phenomenon as a descriptive analysis, which identified how well and effectively computational platform was convivially used by students to learn the course content, provide feedback, forge discussions, share ideas and others. Last but not least, we transcribed the characteristics of convivial computer tools for higher education. To the end of the experiment, we analyzed whether the social networking software could serve as a convivial tool for constructing learning environment, where they use message box, chat and shared discussion wall to interact and collaborate their study in higher education.

5.3. Exploratory and Design Experiment

In this section, we present the example and results of students' participation and sharing of ideas to design their favoured tools and environment. With reference to experiments, students were a user of learning management software; while working together on a project called *"Your Ideal Learning Platform"* to create a new preferred one. Students played two roles when dealing with the application – a user and a designer. They were assigned to explore the current software used in the class, discuss the specification, and share their ideas of a better one. They could also explore other tools for their collaborative projects as they were challenged to create convivial tools from their personal involvement and motivations.

The case studies were intended to create pilot projects that may represent a change agent in learning condition rather than a tool seen within the structure of university system. Each was slightly different, shaped accordingly to the project tasks given in the classroom as well as the learning environment during semester, but all were based on the constructionist methodology. The students discussed, brainstormed and provided tangible prototype of powerful learning environment in the changing digital age.

Our investigation and experiment involved three courses offered to students at Informatik and Digital Media Program at University of Bremen. All case studies were designed as a blended format with regular face-to-face class meetings and electronic learning platform. Before going into detail of each case, we give brief information on the context and background of ICT services at the university, then a short analysis of the campus situation and a review of learning software.

5.3.1. Context and Background at the University of Bremen

ICT infrastructure and services at University of Bremen

At the University of Bremen, there is a matrix organization as shown in Figure 7. Within the central units, there are two key organizations, responsible for the network infrastructure, computing center, and data processing service for students, researchers, tutors, teachers and the administration as depicted in Figure 8:

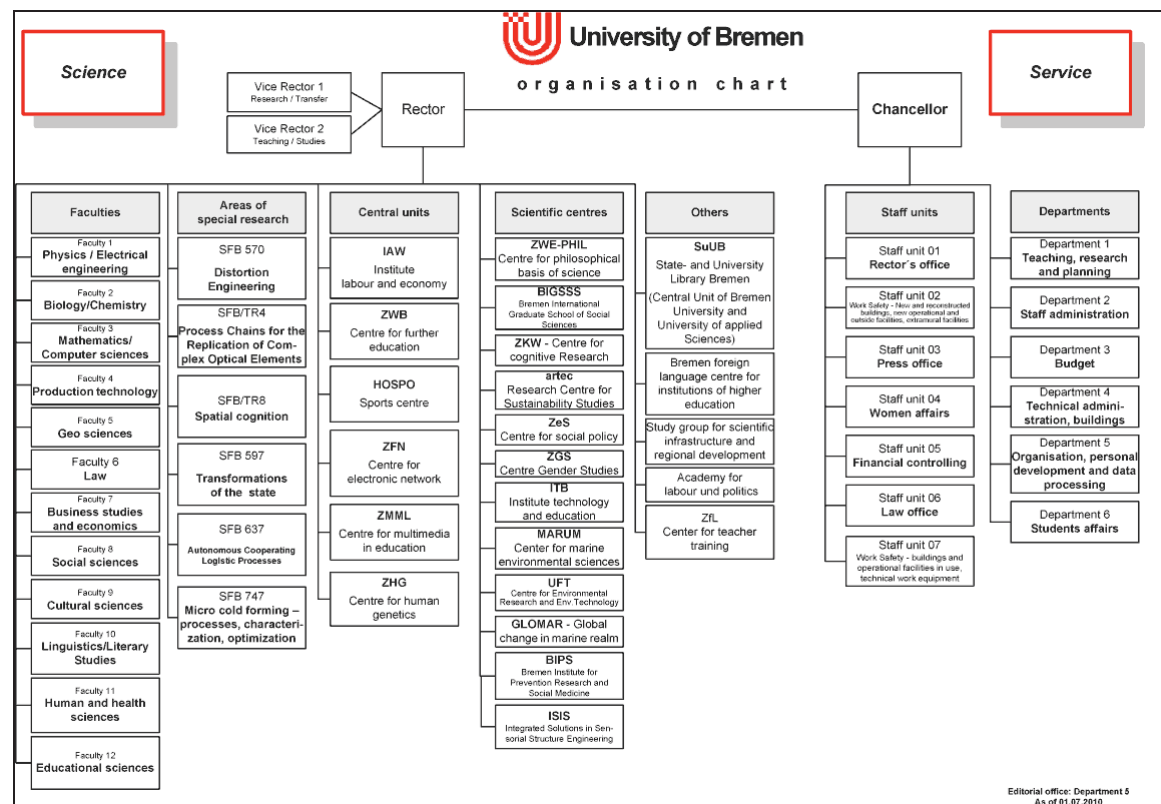
- Zentrum für Netze (**ZfN**)²⁵ und verteilte Datenverarbeitung (in English is Center for networks and distributed computing).
- Zentrum für Multimedia in der Lehre (**ZMML**)²⁶ (in English Centre for Multimedia in Higher Education).

²⁵ <http://www.zfn.uni-bremen.de/zfn>

²⁶ <http://www.zmml.uni-bremen.de/>

Figure 7 : Organization Chart - University of Bremen

(Source from [University of Bremen, 2010])



ZfN

The Center for Networks (ZfN) is a central unit that contributes a customer-oriented service institution for the basic IT needs at the university. The ZfN has the responsibility for planning, innovation and operations of the campus network, running the central server for communication services, counselling and training of users, operating a central computer lab for education and training, and management and output of software licenses.

ZMML

The ZMML is responsible for the development of digital media in campus, technological development and a multimedia development plan of the University of Bremen as shown in Figure 8 and Table 6. Within the university, it is accountable for the integration of digital media in the teaching. The roles of ZMML are to support innovative teaching concepts, coordinate the media equipment, and develop learning concepts for the qualification of teachers. Also the ZMML coordinates to departments and supports faculty members in academic teaching.

Figure 8 : ZMML - Structure

(Source from [ZMML, 2010])

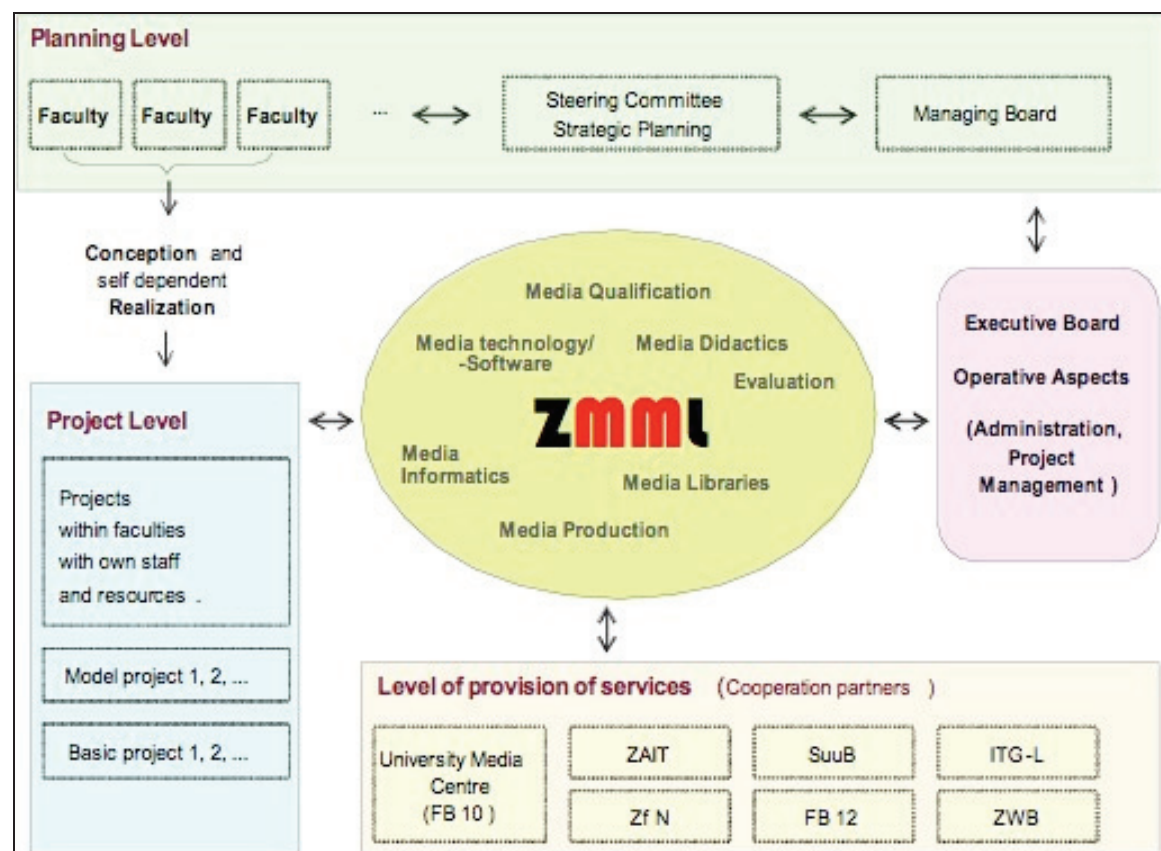


Table 6 : ZMML -Tasks

The ZMML Tasks	Descriptions
Media Teaching Qualification	Teaching basic principles of teaching with digital media
Advice on educational software	Screening and evaluation of existing software either Commercial off-the-shelf (COTS) or open source software
Media Production	Produce and create multimedia tools for the learning systems
Support on technical issues and problem	Account for the purchase of multimedia hardware, equipments, maintenance, and advice the development and the use of local and inter-networks
Coordination and communication	Network the existing activities and share experience within and without the university
Support of multimedia projects	Support all phases of development: design, implementation, and evaluation for both in teaching and in technical aspects
Demonstration of appropriate solutions	Present prototypes for to a broader public
Training, advice and support	Give advises, supports and qualifies to faculty members, lecturers and tutors for using new media either in the classroom or online teaching.
Media Educational consulting	Basic and advanced courses for using the learning platform Stud.IP

5.3.2. Analysis of the Campus Situation

Feasibility study: Software complexity of the current system

We began our experiment by exploring the current learning software. We analyzed Learning Content Management System (LCMS), to know what could be an alternative. We analyzed how the system contributes to university learning objectives, how the current technology and requirement could be engineered, and lastly how the system can be integrated with other new systems.

At the beginning we did a survey and worked cooperatively about information collection and requirement analysis with ZMML [Pusawiro, 2002]. We collected sources of basic information, for instances, documentation and the specifications of similar systems from ZMML and Computer Services, from different departments and faculties. The following questions were asked in the preliminary investigation:

- What learning tools are available?
- What are the goals of such learning tools?
- What are the functions and features of those tools in learning software?
- How will the computer tools improve students' learning?
- Are the tools satisfactory to students?
- Is new technology needed, either for integration or as replacement?
- What kind of pedagogical and learning process is needed for the classroom?

Regarding ZMML project called Mobility on Campus; the university has a global plan to promote the access of campus e-learning system. The most important is infrastructure for Campus-WLAN (Wireless Local Area Network). As a co-promotion with university IT-Shop, they offered a special price to students and staff on a notebook or laptop purchase. This supported the use of mobile platform at University of Bremen.

After analyzing the current situation, we summarized the basic requirements and organized the software features into coherent clusters (read more details report from *the requirement analysis report* to ZMML [Pusawiro, 2002]). The analysis showed a similar result witnessed by the notebook university project [Mobile Campus, 2002] – a problem in prioritizing requirements and resolving requirements conflicts, when a large group of users was involved. Moreover, each department has its own requirements and it is difficult to design a common system to fit all requirements.

Existing Learning platform

To fulfil their course website and platforms, students were introduced to various software platforms; for example, FirstClass, Virtueller Campus, Blackboard, ILIAS, Moodle, BSCW, Stud.IP or even normal website. The University of Bremen has set up a working group and a taskforce to support the learning and teaching with electronic learning management software throughout the university [ZMML, 2004]. In 2003, the project “mobile Campus Universität Bremen” was started and experimented with 18 courses, to evaluate the suitable learning platform and find an innovative way of computer use in education [Mobile Campus, 2002] [dLecture, 2010]. Presently, the mainstream e-learning platform is Stud.IP that is set up, implemented and maintained by [ZMML, 2010]. This central platform serves as an LCMS or MLE service to all students since their first day at the university, to help them manage time plan and lesson learned during semester.

Stud.IP

Stud.IP now serves about 45,303 active courses and 27,115 registered users (as of 30.01.2011)²⁷. Standing for *Stu*-dienbegleitender *I*-nternet-support von *P*-rässenzlehre, it is a free learning platform maintained by ZMML in collaboration with Zait, ZfN, and Die Staats- und Universitätsbibliothek Bremen (SuUB) (in English is the State and University Library Bremen SuUB)²⁸. The services include email services; secure file exchanges; online teaching evaluation; course registration; and identity management. Using the user name and password given by ZfN can access the e-learning platform.

²⁷ <https://elearning.uni-bremen.de/>

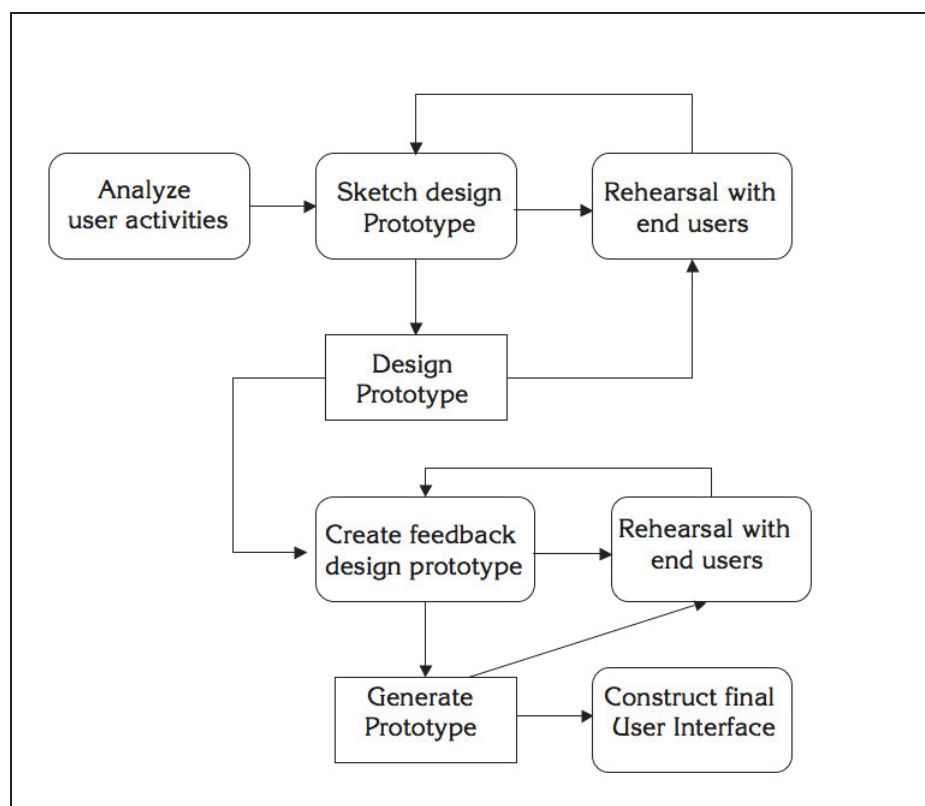
²⁸ <http://www.suub.uni-bremen.de/>

Prototype Design Process

In the experiments, two cases (section 5.4.1 and 5.4.2) focused on a project-based and deploying the prototyping software development process as depicted in Figure 9. We let students create the prototype for their ideal software, hence allowing them to be a software user and designer. The survey of the feasible components and tool requirements derived from the students' need and their actual work rather than suggestions from the lecturer. At the end, students presented their software specification - "Learning Portal" and "Learning Environment" - based on their required services and computer tools in the classroom.

Figure 9 : Prototype Software Development Process

(Adopted from [Schneiderman, 2003])



In creating a "Learning Portal" system in section 5.4.1 and constructing "Learning Environment" prototype in section 5.4.2, students examined the useful components that could be assembled to form the application environment. Students employed a reuse-based approach to define user interface and incorporate learning tools into portal. Those tool components could be calendar, forum, chat, email, announcement and so on. Hence, the components are wired via the interface in order to model a web portal.

5.3.3. Class Experiments: Brief Description

Course 1:

Bremen-WiSe2001/2002: Digital Medien in Der Bildung

In section 5.4.1, we explain the first experiment on the subject of “*Digital Medien in Der Bildung*” (in English “*Digital Media in Education*”). In the course, our experiment required students to design a course management tool and develop a prototype of the “Class Portal” which would be served as a course website and communication channel or CMS for a future class.

Course 2:

Bremen-SoSe2004: Re-thinking Digital Media – Engaging Learning

In section 5.4.2, we explain the design experiment on the subject called “*Re-thinking Digital Media: Engaging Learning*” which was emphasized on “*Analysis and Design the ideal Learning Platform*”. Students learned the software methodology and software development life cycle in order to design the application prototype. Regarding the group work, students sketched software components and functions of electronic learning environment for a future class.

We provided them the fundamental knowledge for the application development, the process of getting the requirements and the prototype design. Moreover, we presented the techniques of software architecture and component-based software engineering in the class. Students read more course materials, discussed and shared ideas on the class-learning platform called FLE. They submitted assignments weekly and wrote reports on the requirement analysis, the feasibility study and the design of application framework.

As shown in sections 5.4.1 and 5.4.2, the courses focused on designing the new effective learning environment in classroom. Students defined problems and specified software requirements. Students used the “System Analysis and Design Methodology” for their software project development. In addition, we also encouraged students to interact with each other by sharing experiences through a group process and computer tools.

Course 3:

Bremen-WiSe2005/2006: Learning in Digital Spaces

In section 5.4.3, we explain the experiment on the subject called “*Learning in Digital Spaces*”. Throughout the lecture, the students learned pedagogical contexts for the development of educational software. We addressed the topics on design software for children as well as for adult education. Students learned the role of users in the design process and questions of general media. This research focused on the “*Dialogues on Tools*” part. We aimed at students to think about the convivial learning tools based on the tools provided by Stud.IP, but not limit to other emerging social networking tools.

5.4. Case Studies: Course Experiment

5.4.1. Digital Medien in Der Bildung

In this section, we explain the first experiment on the subject of “Digital Medien in Der Bildung” (in English is “Digital Media in Education”). According to the course syllabus in Table 7 (See more information in Appendix A), throughout the lecture, the students learn about learning and reflect the role of digital media in learning. Students should exercise a project-oriented method and apply a practical work within interdisciplinary groups. The exercise will be described at the end.

Table 7 : Course Syllabus – Digital Medien in Der Bildung

Subject:	Digital Media in Education
Lecturer	Heidi Schelhowe
Tutors	Werner Amaschus and Priyakorn Pusawiro (only project work)
Modules	VAK 03-05-H-804.03, C 4 SWS, 6 ECTS
Targets	BA Digital Media module 702-I, applied computer science Basic course for the certificate program ITG-L Accredited for EW and learning with technical media
Topic	<ul style="list-style-type: none">• Learning in the Knowledge Society• Potential of digital media• Playing and learning with computers and digital media in the everyday world• Educational software and learning theories• Media literacy
Explore	<ul style="list-style-type: none">• How do educational tasks change in the information society?• What is the way to use media by the net-generation?• What is the specific potential of digital media?• What do they use in educational contexts?

Course Description

Within the course, we set up our experiment by asking a group of students to design a course management tool and develop a prototype of the “Course Portal” or “Learning Portal” which would serve as a course management system (CMS) for a future class. This project was also part of an open project-work, called “Digital Media in Education” at Zentrum für Interaktion mit Digitalen Medien (ZIM) (in English is “Center for Interaction with Digital Media”). Briefly, ZIM is the common learning physical place for all participants – researchers, students, children and young people. These participants may visit anytime to work on the project. ZIM belongs to our research lab and provides the after-school learning environment where participants can drop in anytime and share their skills, develop and experiment with their ideas using digital media.

Course Project

Regarding the “Course Portal”, the main objective is to propose a portal design framework and prototype that can integrate the heterogeneous course websites used at university. We start by presenting students the concept of a portal and the trend of technologies used to design a portal. We injected the portal concept to students’ project because a class website alone is not enough to drill to other related information in the campus. So, instead of using a simple course webpage, the “Learning Portal” may provide an effective learning environment that will promote collaboration and community in learning. We realize that students have different backgrounds and are familiar with different tools for computer-supported learning such as email, discussion groups, chat or e-conferencing, files sharing, calendars, and other web applications. We certainly included tools that are common to students in our design.

Exploration: Portal Function

Portal definition:

“... generally synonymous with gateway, for a World Wide Web site that is or proposes to be a major starting site for users when they get connected to the Web [Whatis, 2001].”

“Software integrating many divergent systems for presentation and use on the Web [uPortal, 2001]”

There are also various meanings of portal. For instance: a gateway to web-based services; a hub integrating information sources; a home-base between web adventures; a single personalized interface to all information resources in a secure, consistent and customizable manner enabling relationship management; a customizable web site²⁹. A portal may store important information, offer the look and feel, save important websites like bookmarks, share files, keep calendars, pick the news, integrate chat, and combine web applications. In some cases, the portal has been designed as a normal home page. Likewise, it serves as a gateway to web access and a hub from which users can locate all the web content they commonly use. It is a user-centric web page.

Most portals are tailored for customization or so-called Customized Personalized Adaptive Desktop (CPAD). Technically, the portal software does it when the user authenticates. The more it knows about the user the better it can perform the customization. Basically, that software determines how a portal looks the first time when a user accesses it. The cohorts, roles, and functions change for the user depending on the hardware configuration. Thus, some portal software may customize differently for different hardware: desktops, laptops, or palmtops or PDA. When the focus is on the individual user, personalization portals are considered [uPortal, 2001]. It allows users to change the portal to suit their work. Users may select the component, namely channel, to display on their screen by their choice. They may set the application parameters such as RSS, page format, calendar and so on, by subscribing or unsubscribing to the modules. All these parameters may be edited, added, or removed by user at anytime.

²⁹ JA-SIG: <http://www.jasig.org/>

As aforementioned, these portals belong to the general-purpose type of portal. As for the “Learning Portal”, students need a knowledge portal as a place for accessing information sources for both internal and external sites. These sources provide both horizontal and vertical information with respect to their needs. It is, thus, considered a student-centric and learning-service portal. We presented students the user interfaces of former “Learning Web Portal” to give them an idea of portal services. These front ends served as a basis requirement for a new prototype design of “Class Portal” as illustrated in Figure 10 to Figure 11. The front end in Figure 12 served as a gateway sample and basis requirements for a new prototype design of “Class Portal” project that will be presented in the outcome section.

Figure 10 : Sample of Class discussion on Portal definition

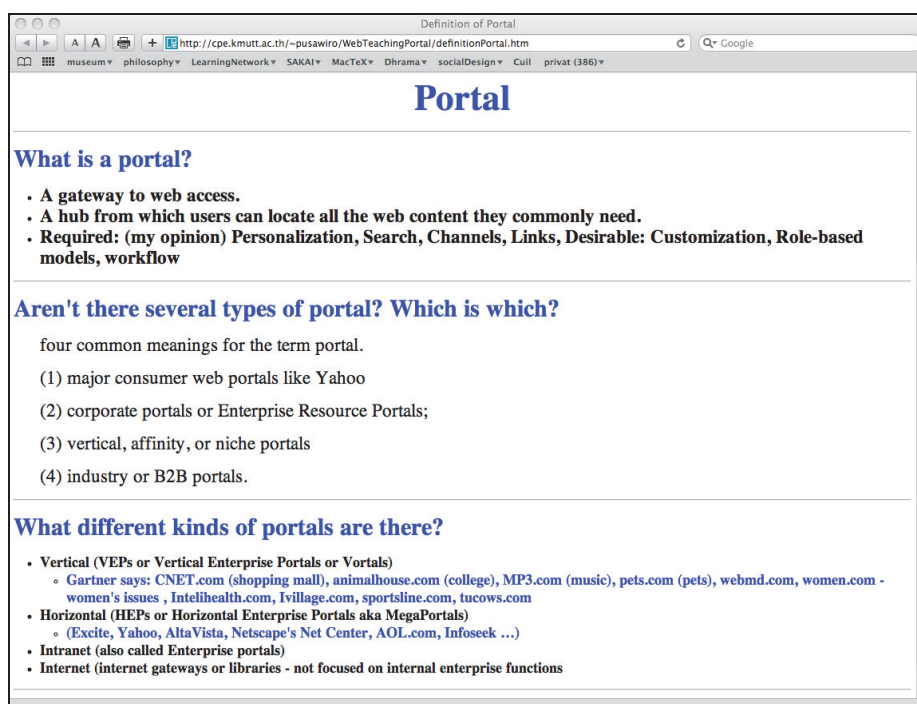


Figure 11 : Use Cases: Portal for Multimedia Teaching

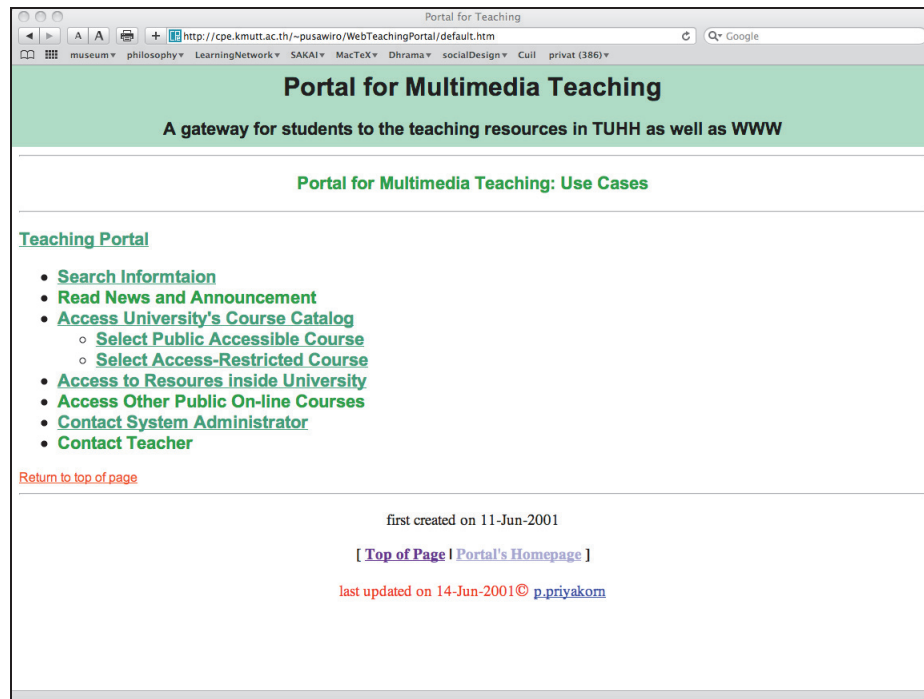
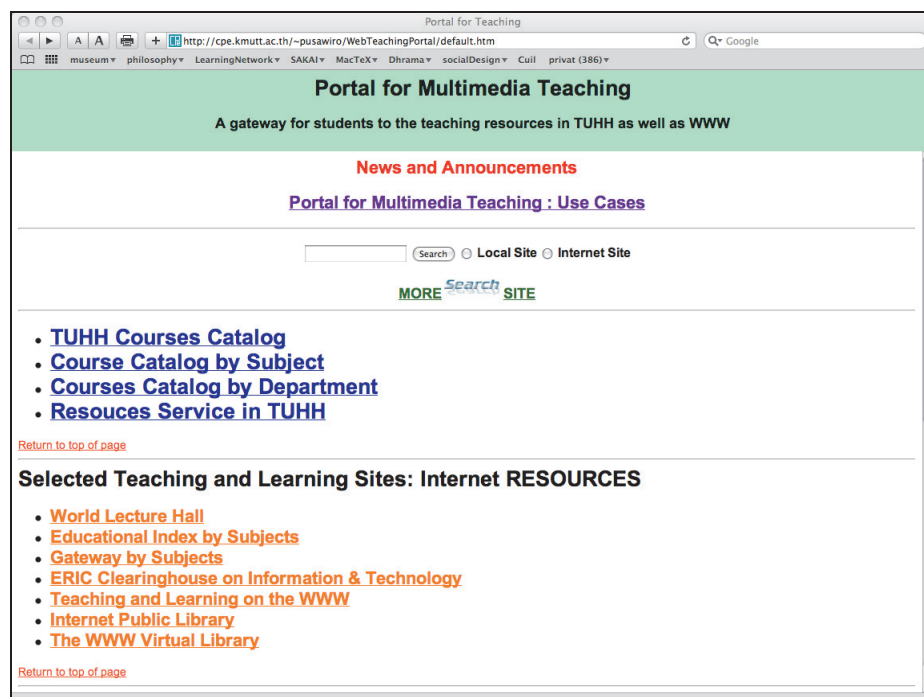


Figure 12 : Course Portal: Portal for Multimedia Teaching
(A sample prototype)



Project Design Experiment

As part of the implementation, we considered the external factors and applied the usability attributes of software engineering concept that affect the development process as summarized in Table 8.

Table 8 : Constructionist Principle in Classroom Usability attributes
(Source from [Somerville, 2004, 384])

Usability attributes	Consideration
"Learnability"	"How long does it take a user to become productive with the system?"
"Speed of operation"	"How well does the system response match the user's work?"
"Robustness"	"How tolerant is the system of user error?"
"Recoverability"	"How good is the system at recovering from user errors?"
"Adaptability"	"How closely is the system tied to a single model of work?"

We also described to students what the system should do for user requirements and explained the system services in detail. In order to sketch the design idea, we briefly taught students about the Unified Modeling Language (UML) [Fowler, 2003]. The UML notations were used for describing the necessary elements of the portal learning framework, mainly for the process activities of architecture and component design. We aimed to show the modelling processes with UML and to describe the generic process models when organizing software. In brief, we explained the UML concepts and asked students to draw diagrams for the course portal based on the UML knowledge as shown in Table 9.

Table 9 : UML Components
(Source from [Fowler, 2003] [UML, 2001])

UML components	Descriptions
"Views"	"Show the various aspects of the system modeled and link the modeling language to the method or process chosen for development"
"Diagrams"	"Graphs describe the contents in a view"
"Model"	"Elements are concepts used in a diagram"

The UML describes the generic process models in the organization and design of the “Learning Portal” processes. The key points are to show the process models and activities involved in producing a portal system. To draw the functional requirements of the portal project, we explained students the detail views of UML for their authentic practices as summarized in Table 10.

Table 10 : UML View

(Source from [Fowler, 2003] [UML, 2001])

UML View	Description
“Use-case view”	“A view showing the functionality of the system as perceived by the external actors”
“Logical view”	“A view showing how the functionality is designed inside the system, in terms of the static structure and dynamic behaviour”
“Deployment view”	“A view showing the deployment of the system in terms of the physical architecture”

UML Diagram: Portal Project

During the project development, we exchanged idea on our sample portal, illustrated UML use-case diagrams and interpreted basic portal requirements to functional services of the "University Portal". In summary, in order to show the interaction between the student and the system when they access the course via a web interface, we sketched the following UMLs as depicted in Figure 13 to Figure 19. These include the Teaching Portal, Access Course Catalog, Access Restricted Course, Access Public Course, Access Resource inside University, Search Information, and Contact Administrator scenarios, respectively.

Figure 13 : Teaching Portal

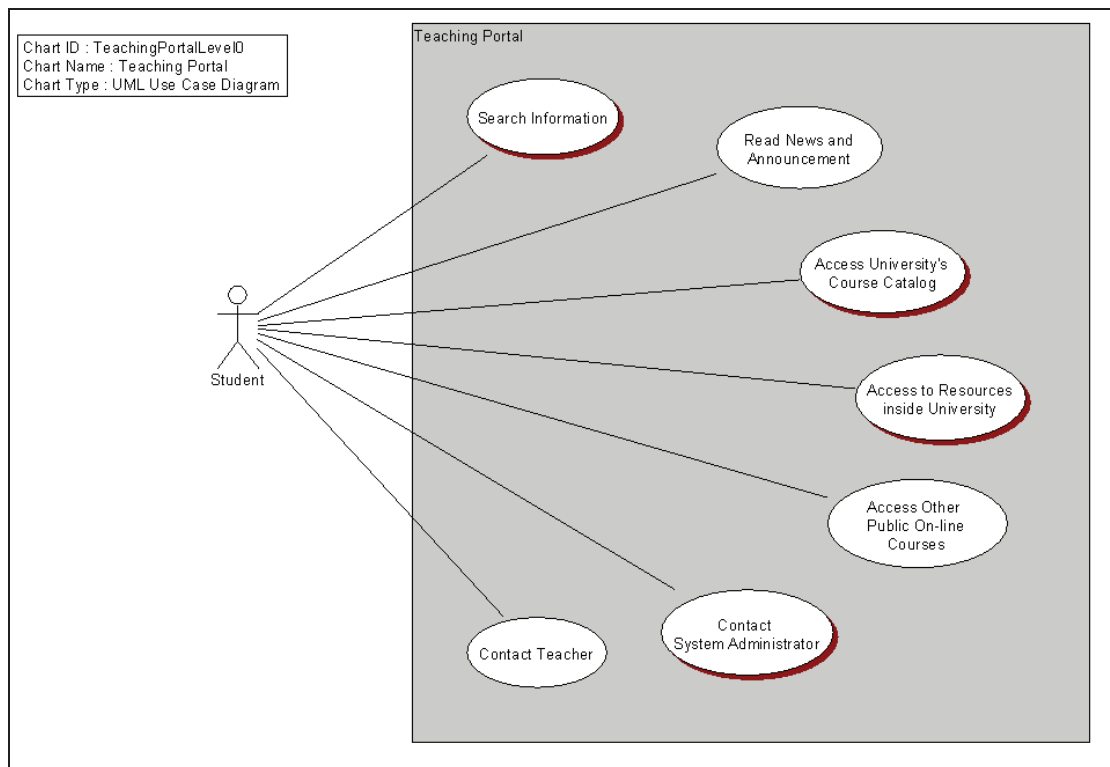


Figure 14 : Access Course Catalogue

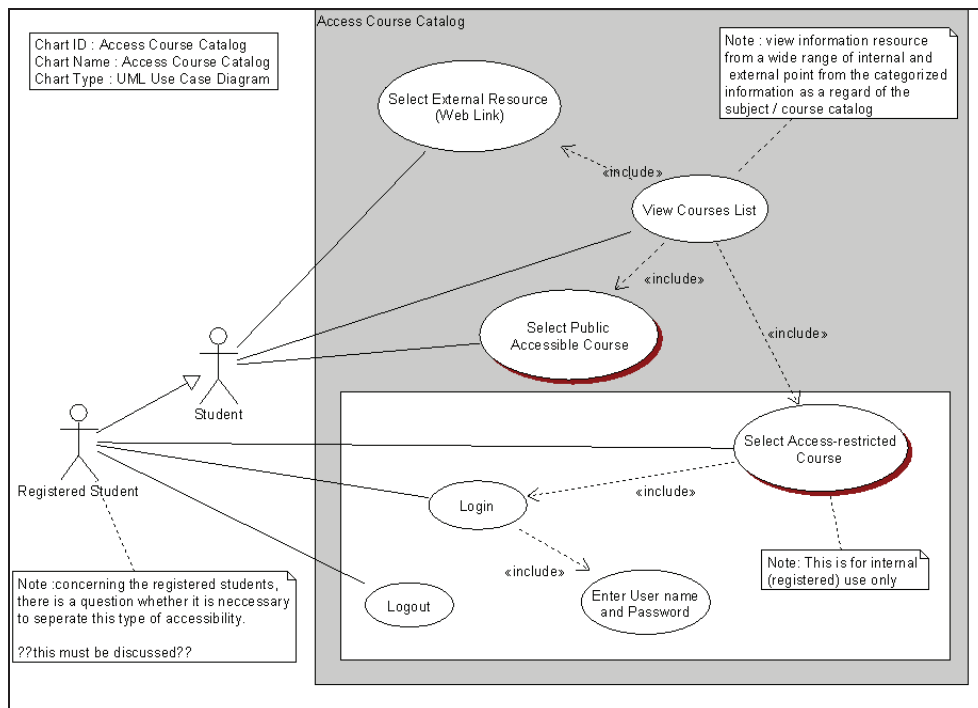


Figure 15 : Access Restricted Course

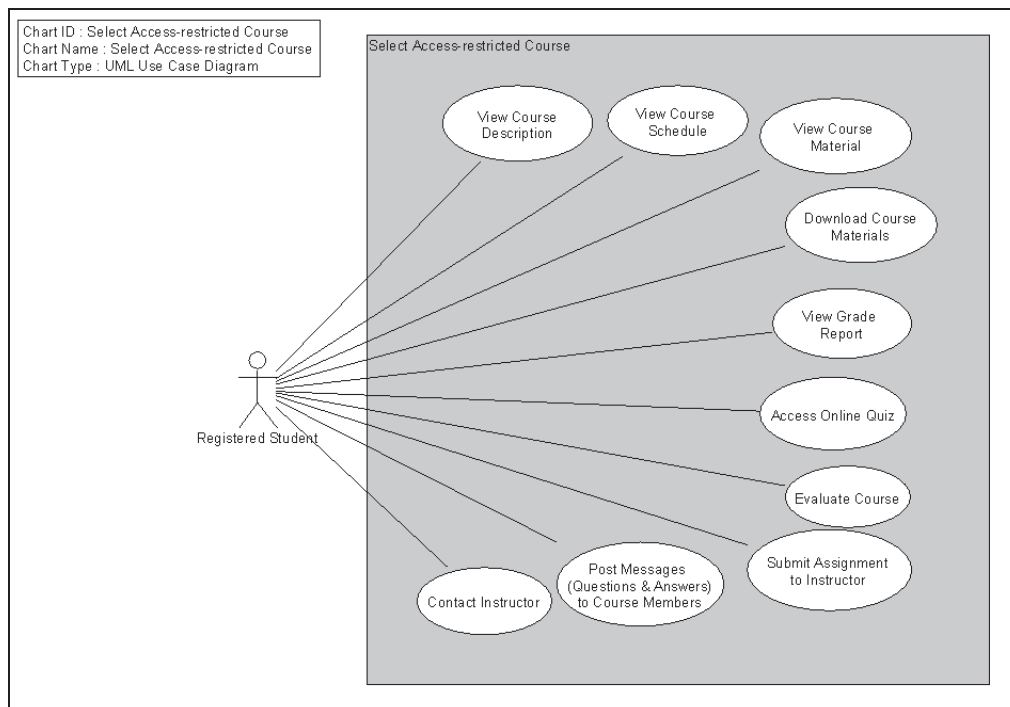


Figure 16 : Access Public Course

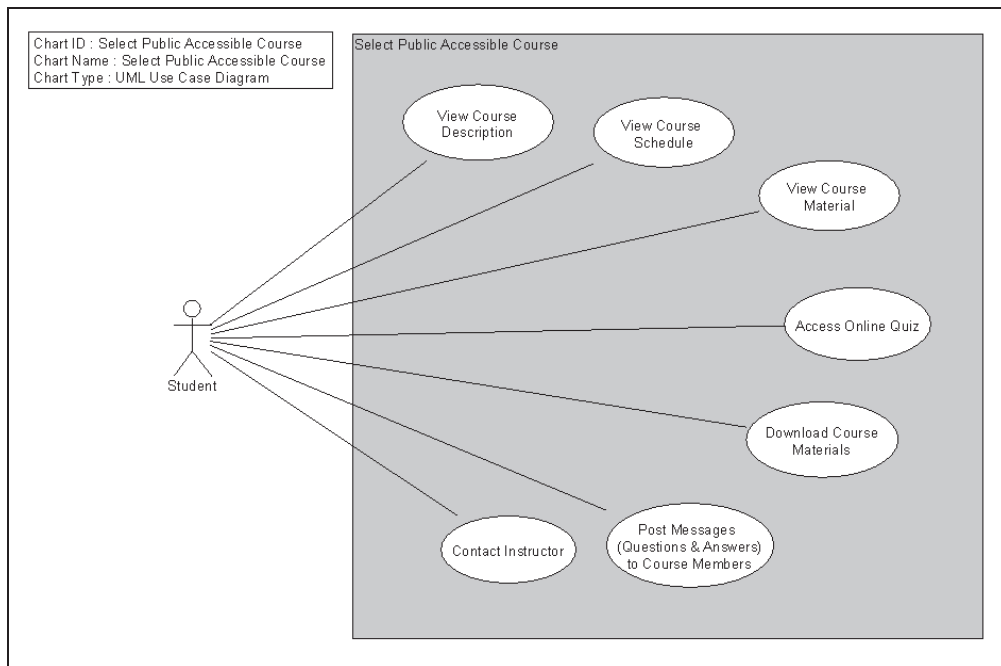


Figure 17 : Access Resource inside University

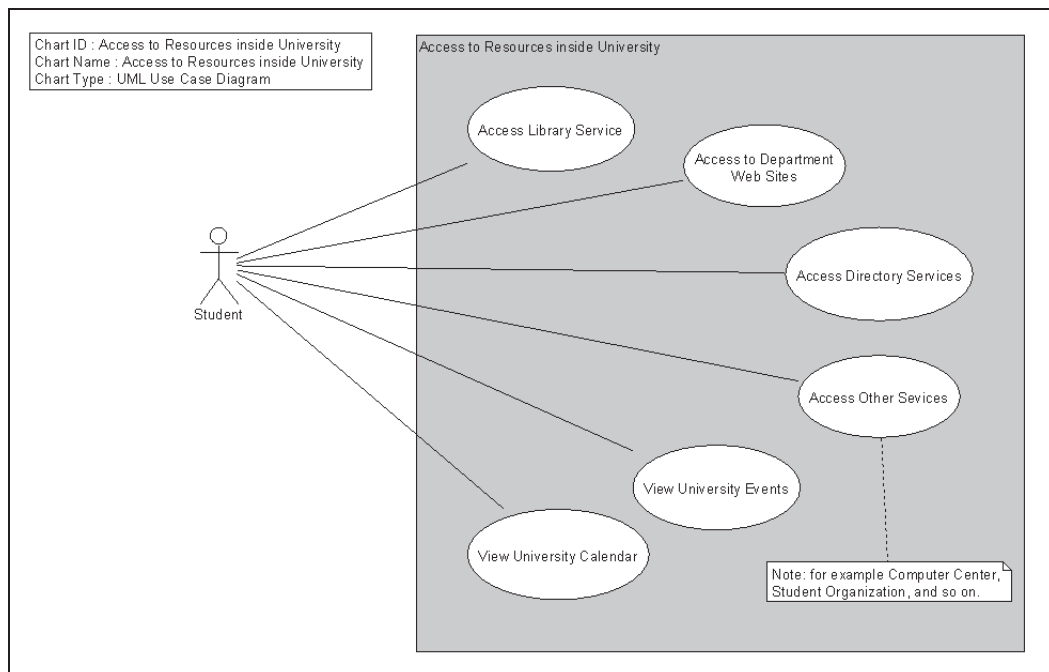


Figure 18 : Search Information

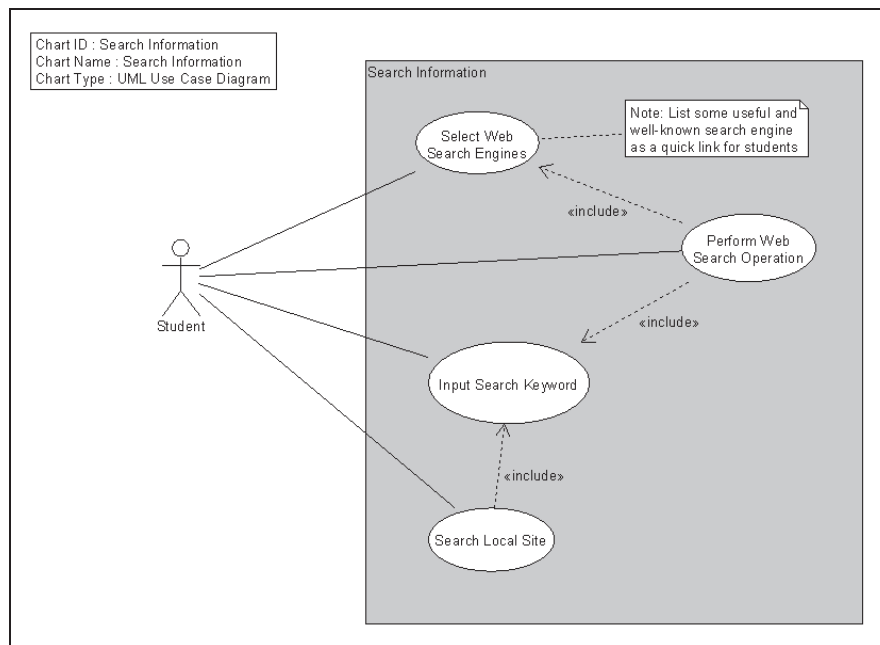
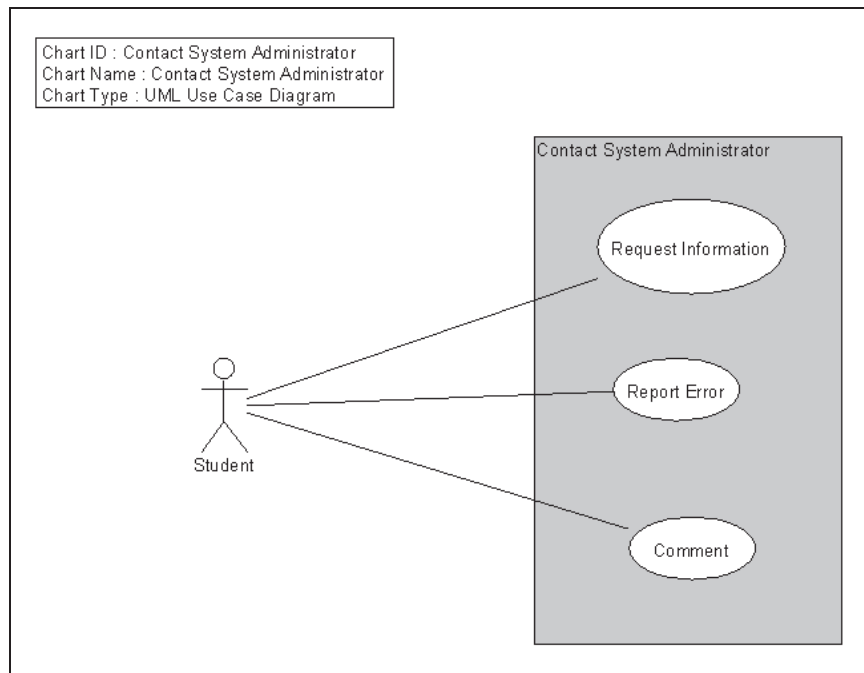


Figure 19 : Contact Administrator



Course Outcomes

So, what are our basic requirements? That is a single campus portal for everyone at the university with a single sign-on, extensive customization and personalization features, and ease of adding both local and global channels as shown in Figure 20 and Figure 21.

Figure 20 : Portal: Components and Functions

(Source from uPortal [uPortal, 2001])

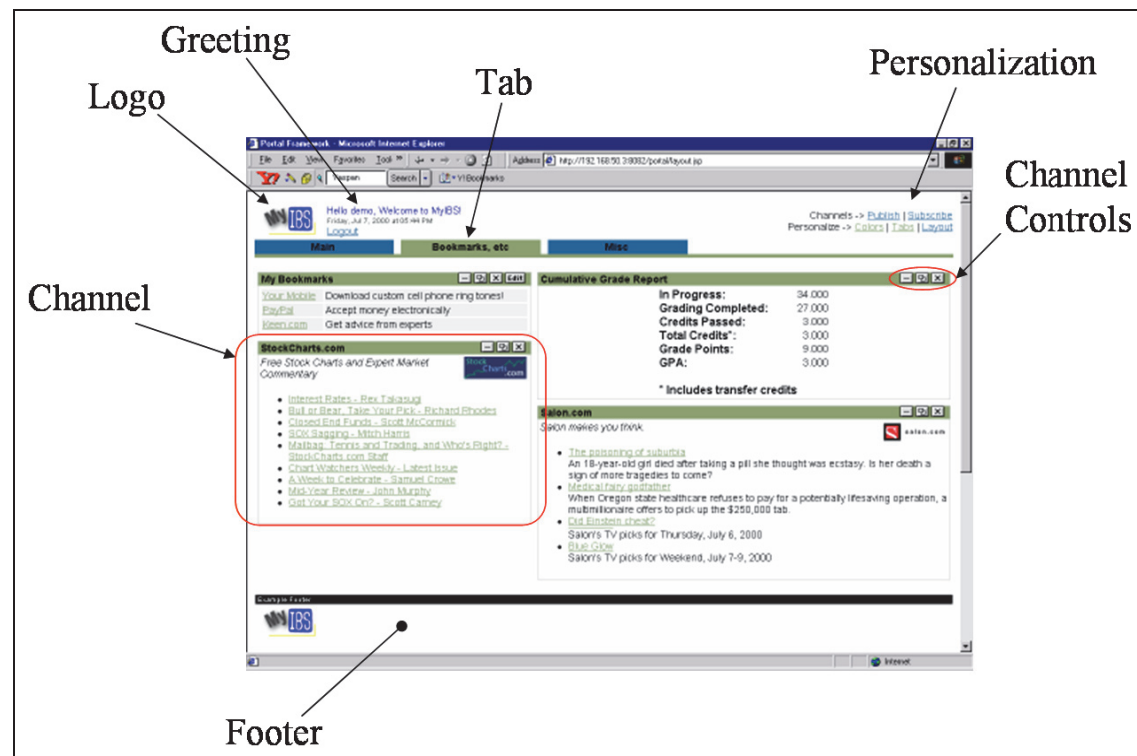
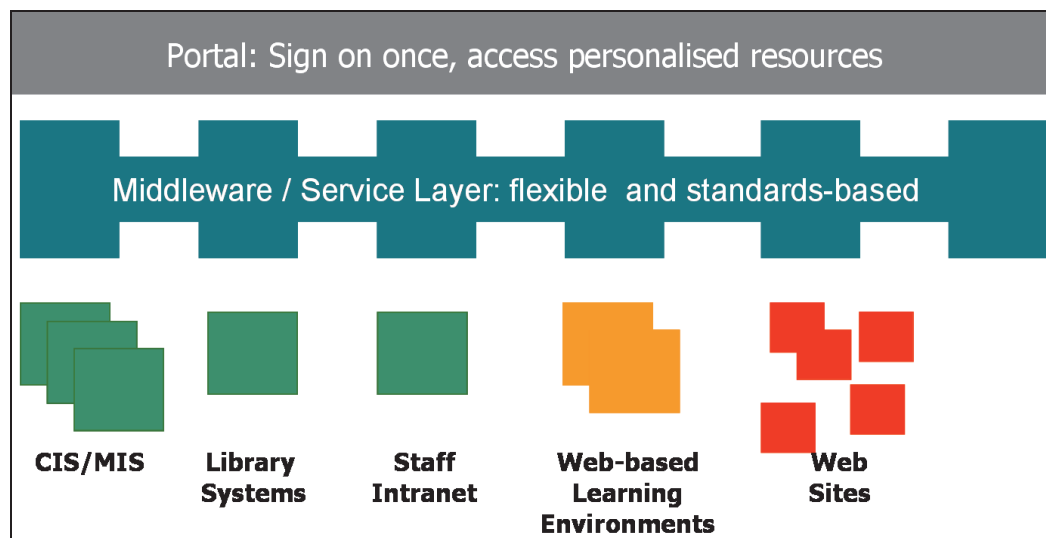


Figure 21 : Portal: Structure and Layer

(Source uPortal [uPortal, 2001])



Final Prototypes

In the implementation, the tool should be a reusable component, standard module, open, extensible and robust. In design, the aggregated layout is implemented to support tool components. As seen from the above UML use cases and feasible components, the student re-designed a "Learning Portal" and made a better-syndicated interface. This aggregated system allows students to navigate the content easier at one point as depicted in Figure 22, Figure 23 and Table 11, respectively.

Figure 22 : Zentrum für Interaktion: Web Learning Portal

Zentrum für Interaktion

Aktuelles

- Alle Meldungen
- Projektinformationen
- Studium
- Öffentliche Kurse
- Blindtext 2

Impressum

- Über das Zentrum
- Projektträger
- Impressum
- Webmaster
- Kontakt zum Zentrum

Artikel

Maschinenspezifische Bedienpulte werden durch Computer ersetzt

Um aufwendige Eigenentwicklungen von Hard- und Software für maschinenspezifische Bedienkonsolen zu verringern, werden vermehrt etablierte Standards aus der Rechnerwelt übernommen. V...

mehr...

Topic gestartet von: [] 01-27-2004 at 01:00 PM
Kommentare total: 31 | Antwort Schreiben

Mobile HCI in production environments

Future 4G technologies will create compared with today's technologies vast changes on the technical equipment, the human factors of software-systems, the media competencies of users and the methods of education. ...

mehr...

Topic gestartet von: [] 11-27-2006 at 07:00 PM
Kommentare total: 53 | Antwort Schreiben

HCI depending on the environment

The solution to be expected is an object-based surface on a mobile device, which shows the model of a production system with the help of symbols....

mehr...

Topic gestartet von: [] 171-27-2005 at 04:40 PM
Kommentare total: 2 | Antwort Schreiben

Login - Account

Username:

Password:

Login!

Sie haben keinen account?

[Registrieren Sie sich !](#)
[Passwort vergessen ?](#)

Statistik

User Online: **15**
Total Mitglieder: **6871**
Forum Threads: **300**
Forum Posts: **1027**
Usenet Threads: **845**
Usenet Posts: **346671**
PMs in MailBoxes: **74381**

Unser neuestes Mitglied:

Figure 23 : Zentrum für Interaktion Portal: Web Presence

The screenshot displays the 'Zentrum für Interaktion' portal. At the top is a banner with the portal's logo and the text 'Zentrum für Interaktion'. Below the banner, the interface is organized into several sections:

- Navigation:** A sidebar menu containing links for 'Aktuelle Meldungen', 'Termine', 'Suche', 'Guided Tour', and 'Hilfe'.
- Intern:** A sidebar menu containing links for 'Online Vorträge', 'Recherche Hilfen', 'Schwarze Brett', 'Diskussionsforen', 'Arbeitsgruppen', and 'Projekte'.
- Private Menu:** A sidebar menu containing links for 'Eigene Termine', 'PM Box', 'Workspace', 'Chat', 'Homepage', 'Einstellungen', and 'Info / Status'.
- Willkommen, Testuser !:** A central section with a blue header. It displays a message: 'Sie haben 4 neue persönliche Nachrichten:'. Below this is a list of messages with their subjects and timestamps:

Message Subject	Timestamp
Hallo Testuser ! Wie ...	11-27-2006 at 07:00 PM
Mitteilung: Am 30.12.2999 ...	10-37-2006 at 03:00 PM
Achtung: Virus im ...	05-77-2006 at 07:33 PM
Hi Testuser ! Habe Dich am ...	01-17-2006 at 97:10 PM
- Status:** A sidebar on the right showing login information: 'Sie sind eingeloggt als: Testuser', 'Online seit: 00:00:03', and 'Automatisch ausloggen: eingechaltet'. It includes a 'Logout!' button.
- Neue Dokumente im Workspace:** A section below the messages listing recent documents:
 - Mobile HCI in production environments
 - Mobile HCI exclusions
 - Conference Part 1. rm
 - Arbeitsplan.doc
 - Conference Part 1. rm

Table 11 : Function of Component Web Presence

Web Learning Portal	Component Web Presence
Login	Enter user name and password Registration and help
Aktuelles	Update news and announces in campus Project information Academic information Public information zone
Impressum	Information About Zentrum für Interaktion
Artikel	Resources and Course Materials Discussion information Question, comment and answer
Statistik	Monitoring information and statistics
Willkommen	Welcome Screen and personalization: news, information, announcements and resources
Navigation	Update news, Schedule, Search, Guided Tour and Help
Intern	Online lecture, computer services and helpdesk, discussion forum, group working and project information
Private Menu	Customization information and menu such as workspace, chat, homepage, option setting and personal data status
Status	Online status and information Logout command and set-up

5.4.2. Re-thinking Digital Media: Engaging Learning

In this section, we explain the design experiment on the subject of “Re-thinking Digital Media: Engaging Learning” which was emphasis on a project-based learning in the course, we focused on software methodology and software development life cycle. Throughout the lecture, the students learn about learning and reflect the role of digital media in learning, according to the course syllabus and course methodologies and Requirements in Table 12 (See more information in Appendix A).

Table 12 : Course Syllabus –Re-thinking Digital Media: Engaging Learning

Subject:	Re-thinking digital media: Engaging Learning
Lecturers	Prof.Heidi Schelhowe and Priyakorn Pusawiro
Modules	VAK: 03-899.52 / Module 702-2 (ECTS: 6 -180 hours)
Targets	MA Digital Media module 702-2
Topic	<ul style="list-style-type: none">• Introduction and Overview of the course• Engaging Learning• Computer Supported Collaborative Learning• Theoretical issues in education and computer science• Communities of Learners and of Practices• Digital media – the interactive media and the digital tools• Object-oriented multimedia, multimedia framework and integrated multimedia system• Design, analysis and evaluation computational system• Conduct a hands-on project
Goals	<ul style="list-style-type: none">• To explore of digital media, esp. the interactive media and the digital tools.• To exchange idea of "Engaging Learning", esp. Learning Process.• To think and examine digital, esp. new media for education.• To analyze and design the digital media/technologies as a computational tools for learning.• To share understanding and construct the knowledge concerning "Re-thinking a digital media: Engaging Learning" via a collaborative learning environment platform.

Course Description

This course explored the digital media, esp. the interactive media and the digital tools used for "Engaging Learning". Seeing as new technologies make possible new approaches to learning, therefore students should re-think to understand the tool function and examine digital media to see how each tools can be engaged into the creativity and learning processes.

Generally, the goals of this course were to analysis and design the digital media technologies – the computational tools in education which may facilitate radical change on how and what we learn nowadays in digital age. The course syllabus was broken down into interdisciplinary issues in education and computer science – object-oriented multimedia, a multimedia framework, integrated multimedia system, a design and analysis computational system, and a project-based learning.

During the course students could become both users and designers of educational "Digital Media" tools. Through the semester students have to participate in and reflect on a variety of learning circumstances, including: learning from a friend, teaching something to a friend, participating ZIM, and learning on your own. In addition, we also encouraged student to interact with each other by sharing experiences and generally through the dynamics of a group process and computer tools. We used the FLE platform for this case study.

Students should read, discuss materials, conduct a hands-on project, share understanding and construct their knowledge concerning "Re-thinking a digital media: Engaging Learning" via FLE.

Course Project

As we assigned at students to work together via a project – *object-to-think-with*, thus students share idea via face-to-face in the classroom and on electronic learning environment. We engaged student a concept of learning-by-making.

The courses were emphasis on designing the new effective learning environment in classroom. Indeed, we assigned student to construct the "Desired Learning Environment". Students defined the problem and set out the software requirements. Students used the "System Analysis and Design Methodology" for their software project development. Therefore, we taught students some knowledge on database design, software development, and the prototype design. Moreover, we presented the techniques of software architecture and user interface design process in the class as formerly shown in Figure 4. They read course materials, discussed and shared idea on the class-learning platform – FLE. In addition to FLE, we gave students some examples of trendy learning platform, which target to university level, like uPortal and SAKAI.

Students should have to submit assignments weekly and write report on the requirement analysis, the feasibility study and the design of application framework. Finally, students presented final project and proposed the analysis and design of CLMS for a future class.

Course Methodologies and Requirements

Throughout this course we employed the class methodologies as shown in Table 13.

Table 13 : Course Methodologies

Class Methodologies	Descriptions
Active Participation	<p>Students are expected to become familiar with collaborative learning via Web-Based Learning Environment as a Knowledge-Sharing-Building Platform, so-called FLE.</p> <p>Interaction in the class, Group Work, Face-to-Face Meeting during the semester.</p>
Readings	<p>The participants are expected to do the readings, and to participate in discussions of the readings both in the class and via Web-Based Collaborative Learning Environment (CLE).</p> <p>The participant must critically read the assigned papers before attending in the class in order to contribute their thoughts and ideas to other members of the class actively.</p>
Class presentations and Digital documentation	<p>Participants should summarize the readings, then document the learning information and project idea then post onto our learning community – FLE platform.</p>
Group work	<p>Design a “digital media and computational tools” which make learning is more powerful and meaningful for learners.</p> <p>Collaboratively analyze, evaluate and re-think about those tools in order to suggest a new design for “digital media: Engaging Learning”</p> <p>Present as design experiment and prototype of computational tools for engaging learning.</p>

Course Content: Basic Knowledge in Software Methodologies

We presented the developing software concept to student. It is commonly known that most developers begin with the investigation of the problem to see what the requirements of the system are. It is an analysis task. Then, it comes to design process of how the solution should be solved in order to fulfil those requirements. It is a design task. Both analysis and design are key activities in software development process. To work on software project, we presented students the influential concepts of software development process during the semester, according to [Rumbaugh et al., 2003] [Somerville, 2004] [Fowler, 2003] [Shaw and Garlan, 1996]. At least students could keep in mind the working steps and inquires in Table 14.

Table 14 : Classroom Software Development Process

Software Development Process	Inquires
Planning	Why build the system?
Analysis	Who, what when, where will the system be?
Design	How will the system work?
Implementation	How does system delivery?

In this case study, we described students some key concepts of *software architecture and component-based software engineering*, which is the design process for identifying the sub-systems [Shaw and Garlan, 1996]. Students analyzed the computer tools in learning platform as a component-based and service-oriented systems in order to easily link the shared services and reuse application frameworks [Szyperski, 2002] [W3C, 2004] [SOA, 2004].

In fact, we trained our students on software analysis and design via the project-based learning and discussed productively in each step both via face-to-face and inside FLE platform as shown in Figure 24 to Figure 26 with the process from Table 15.

Table 15 : Project Domain and Step of Software Design

Project Domain	Step in-class
Constructing the Learning Environment in Higher Education	<p>Identifying application domain</p> <p>Analyzing the feasibility of learning software platform at university level by gathering existing information and by modelling both process and data</p> <p>Propose the possible physical design, interface design and architectural framework of convivial computer tools</p> <p>Demonstrating a prototype implementation of learning environment in classroom</p>

Figure 24 : Face-to-Face and Social Interaction in Classroom



Figure 25 : FLE Platform: Collaborative Project Topics

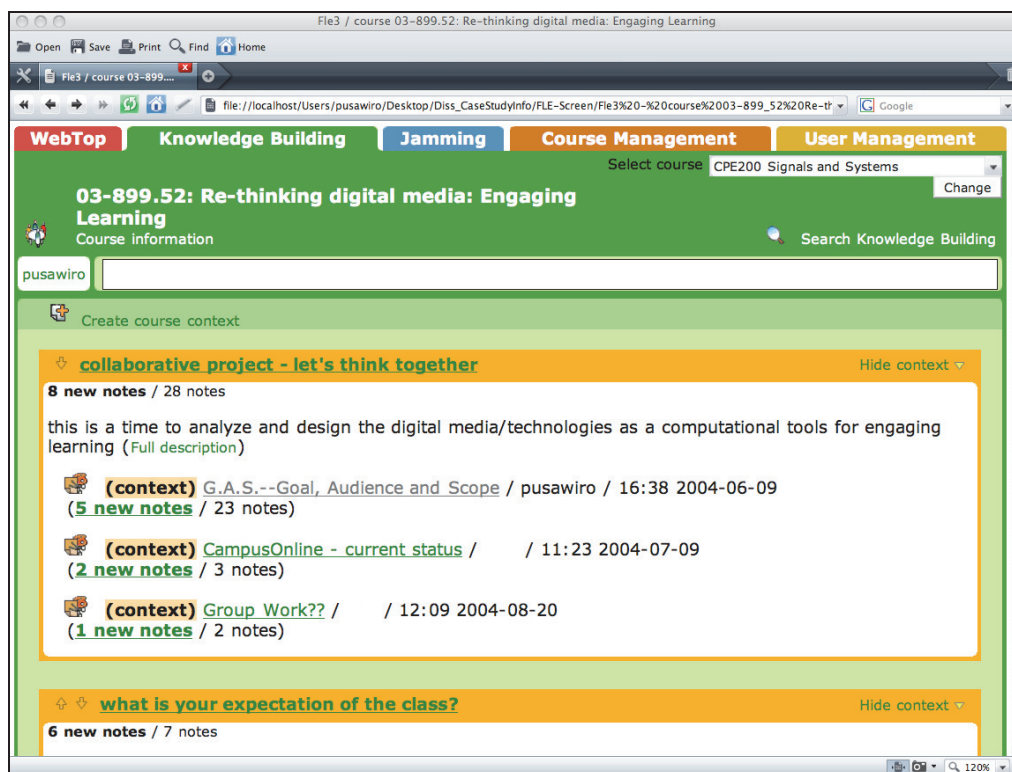
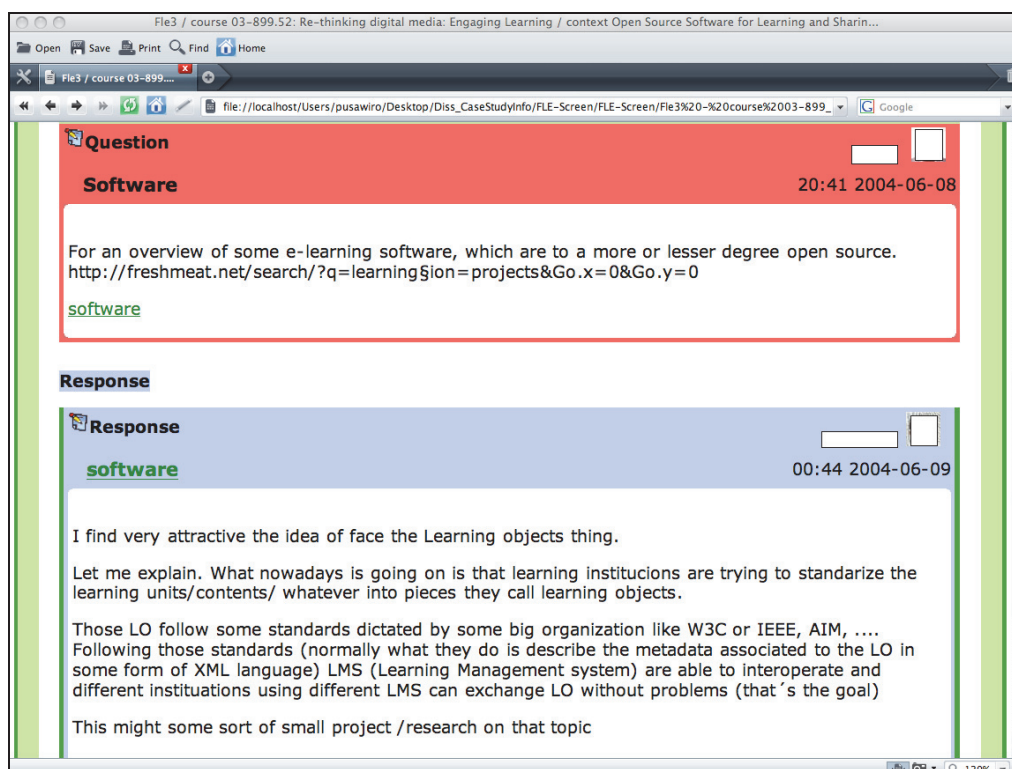


Figure 26 : FLE Platform: Collaborative Project Discussion Forum



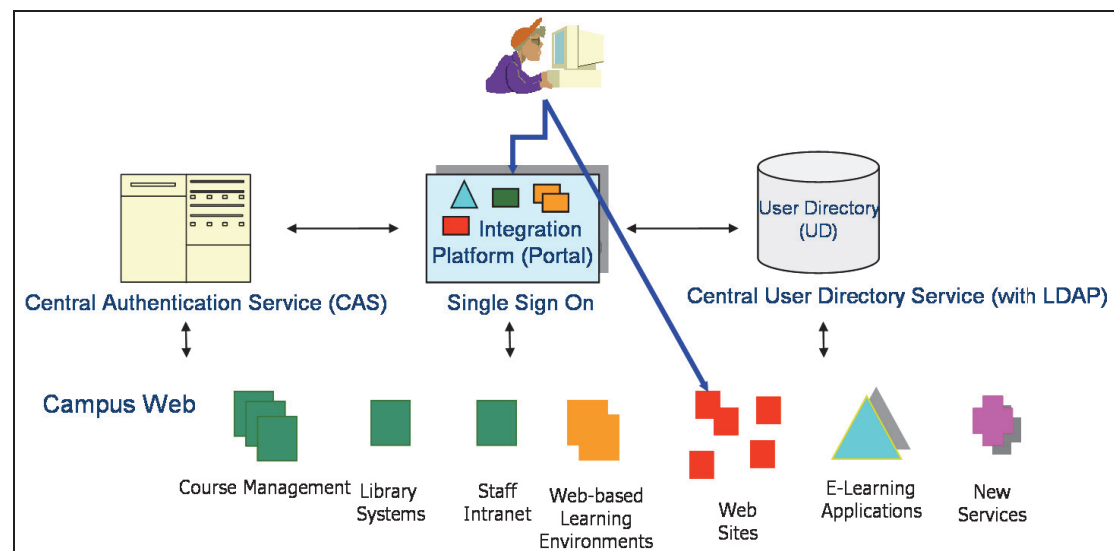
Course Project: Technology Survey Report

In the class we surveyed and studied the enabling technologies as well as emerging learning platform. We studied the possible framework, which may use for designing the CLMS such as the web technologies and the enterprise platform architecture. To stay tune, students have to survey the state-of-the-art technologies and identify a useful technical solution for constructing the learning environment.

So far, the University of Bremen has the plan to establish a common e-Learning platform for all faculties. After gathering the organizational requirements, we found that the university has also set up the policy framework to general portal as a single point services as depicted in Figure 27 [uPortal, 2004].

Figure 27 : University Portal Plan and Deployment Modules

(Source from [uPortal, 2004])



Students reported and compared the software component framework, namely *J2EE* and *.NET* that may use for integrating different components. Regarding the survey similar software, students reported that *Java* has been proved successfully in open source development [Sourceforge, 2004], explicitly in higher education. For instances, uPortal [uPortal, 2004] in Table 16 and SAKAI in Table 17 [SAKAI, 2004].

Project Survey Report: uPortal

Table 16 : uPortal Summary Report

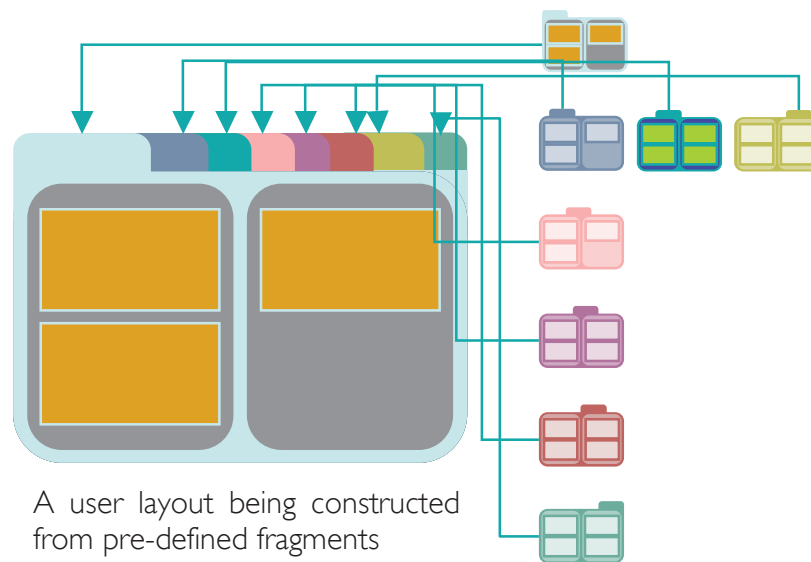
(Source from [uPortal: <http://www.jasig.org/uportal/>])

Learning Environment	uPortal
Description	<p>A sharable platform for the campus web presence and a java based portal framework.</p> <p>“uPortal is built on open standards-based technologies such as Java and XML, and enables easy, standards-based integration with authentication and security infrastructures, single sign-on secure access, campus applications, web-based content, and end user customization. It is one of the most widely deployed open source enterprise portal frameworks, having been adopted by hundreds of institutions and the eResearch community, worldwide” [JA-SIG http://www.ja-sig.org/].</p>
Framework	Open Source and Based upon open-standards and Java,XML, XSLT, JSP and J2EE development
Main features	<ul style="list-style-type: none">• Framework for aggregating contents, so-called channels• Personalization• Role-based access control• Single sign-on
Channel or Tool Aggregation	<ul style="list-style-type: none">• Calendars• To-do lists• Discussion groups• e-mail and chat• Reports, documents• Schedules• Data warehouse access• Map• Image• Charts• Workflow• Collaborative tools

In summary, the uPortal offer a single web interface for various services and information. Thus, no more login is needed for email and other services after entering to Portal. Users can also select which services to appear, while different users can have different portals as illustrated in and Figure 28.

Figure 28 : uPortal User Layout

(Source from [JA-SIG <http://www.ja-sig.org/>])



Project Survey Report: SAKAI

Table 17 : SAKAI Summary Report

(Source from [SAKAI: <http://sakaiproject.org/>])

Learning Environment	SAKAI
Description	<p>Sakai is a collection of open source tools developed by a large number of universities to provide a supplementary learning environment.</p> <p>Sakai is a community-source collaborative learning environment (CLE) and courseware management platform that provides users with a suite of learning, portfolio, library and project tools.</p>
Framework	<p>Open Source implementation of the Course Management API so-called Sakora</p> <p>Sakai offers a Course Management API supporting plug-ins that provide to Sakai information about the courses and enrolments at the deploying institutions.</p>
Main features	<p>CLE Features Supporting Learning Management</p> <ul style="list-style-type: none">• Announcements, News and Calendar• Blog and Wiki• Chat and Discussion Forum• Drop Box• Email Archive• Syllabus, Resources and external Web Page• Assignments, Tests, Quizzes and Gradebook• Glossary <p>Social knowledge connections for academic</p> <p>Create a network of people able to answer questions and provide feedback</p> <p>Leverage networking while maintaining full privacy and security</p> <p>Connect shared interests with scholarly pursuits</p> <p>Foster connections between groups of students, teachers, and researchers</p>

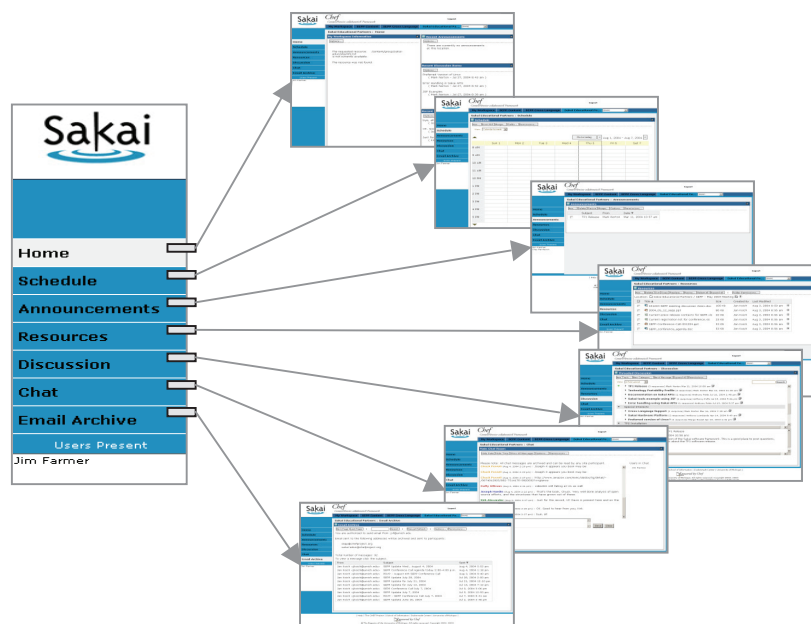
In summary, the SAKAI offers two platforms, which are Sakai Collaboration and Learning Environment (CLE) and Sakai Open Academic Environment (OAE), respectively, as shown in Table 17. According to SAKAI project website, the former is a robust system to enhance collaborative teaching, learning and research. The latter is a new vision for academic collaboration that enhances Sakai CLE [SAKAI, 2004]. Sakai Architecture Framework is break down functionality into three elements as bellows:

- Presentation code giving the look, feel, and layout
- Tool code managing the interactions with the user
- Service code for business logic and persistence

To Sum-up, The design of Sakai, as depicted in Figure 29, is a common approach often called “Model-View-Controller” that we use in our software prototype.

Figure 29 : User Interface and Model-View-Controller

(Source from [SAKAI: <http://sakaiproject.org/>])



Course Outcomes

Architectural Design Framework and Tool Components

At university, the information processing is distributed over several servers rather than confined to a single machine. However, they may share resources, provide an open access and add a new resource to enhance performance of its existing system. The architectural system may design either as client-server architectures or as distributed object architectures. To the project a co-constructing learning platform, the students proposed the three-tier architectures for the complex enterprise application, the system is commonly designed as layered application architecture as summarized in Table 18. Each of the application architecture layers may execute on a separate processor. This allows for better performance and is simpler to manage. This is a more scalable architecture as demands increase; the extra servers can be added. This architecture type benefits for a large-scale applications with hundreds or thousands of clients. Also, the data from multiple sources may be integrated into the application easily.

Table 18 : Functions of Three-Tier Architectures

(Source from [Somerville, 2004, 270])

Layer Type	Function
“Presentation layer”	“[Presenting] information to user and with all user interaction”
“Application processing layer”	“[Implementing] the logic of the application”
“Data management layer”	“[Managing] the database operations”

During the course, students also explored alternative way to integrate the available learning management software in the campus. They found that Service-Oriented Architectures (SOA), specifically Web Services, could enable the legacy system to become a service-based [SOA, 2004]. SOA units are modularize, replace functionality with services, rely on open standards for exchanging data, and create community standards for exchanging information.

Therefore students designed a new system that could be able to add concrete classes into. In designing so, the students viewed the whole system as socio-technical components that include computer hardware, software and people to suggest a global view of design specification. Students exchanged idea via FLE, summarized protocols and minutes, sketched user interface and presented a database design and as shown in Figure 30 to Figure 35. To wrap-up, the projected proposed the following prototypes, as depicted in Figure 31 to Figure 35, for constructing the learning environment to the future class.

Figure 30 : FLE Platform: Collaborative Project Interaction

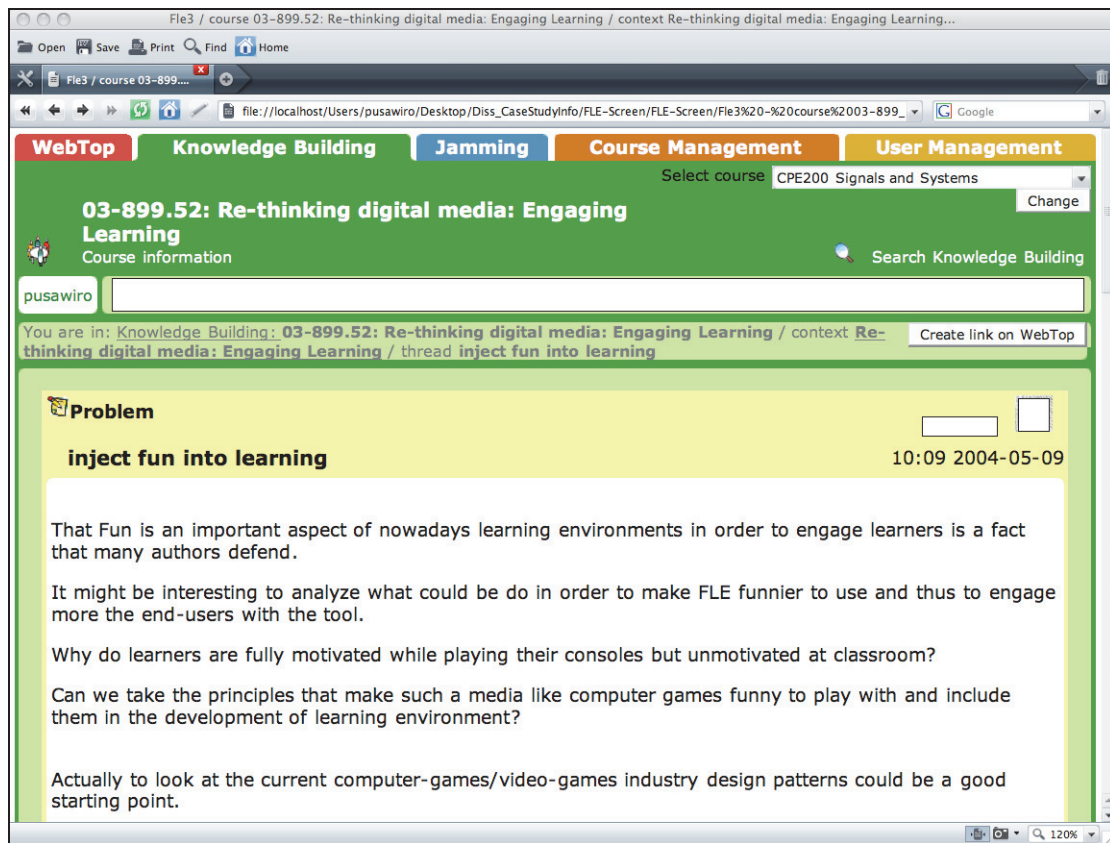


Figure 31 : Database Design Result

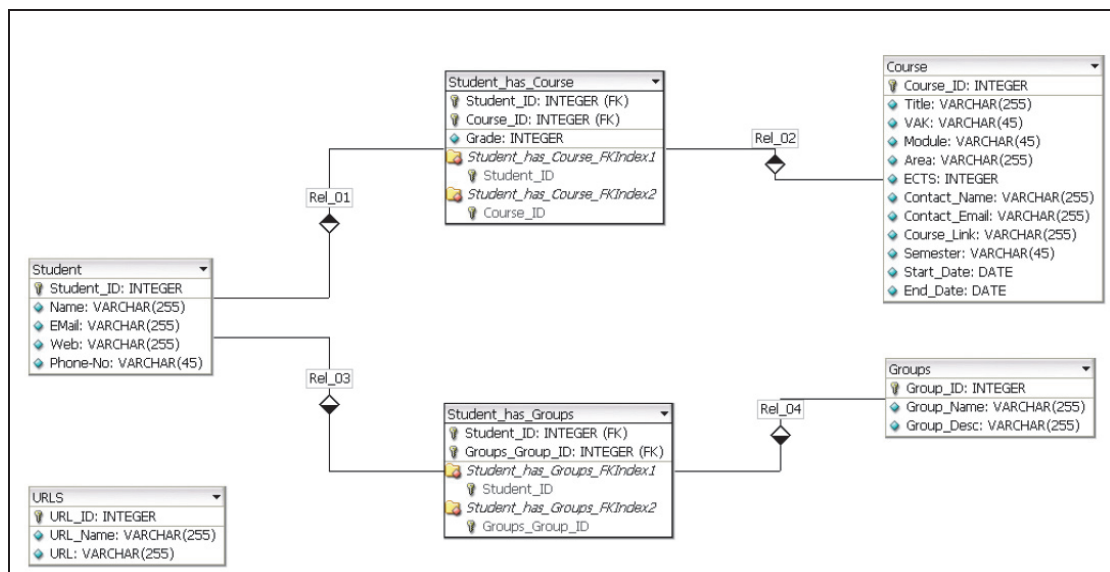


Figure 32 : Collaborative Project Interaction: Protocol and Minutes

Protocol 30.06.04
Participants : <input type="text"/>
<input type="text"/>
Topics discussed
<ul style="list-style-type: none">• Database is setup and running along with the server.• The server is accessible via SSH and MySql session• Eric proposed to some HTML pages with links to some already existing tutorials and also add a learning block. This way we can integrate his idea of learning with the portal.• Insert few links with the portal that would interest the students. For e.g. link to Bremen services.• All groups please upload the CVS repository with the basic structure of their works so that the documentation group can start their work based in these structures.• Documentation group should start working on the goal, scope and idea of the project.• All of us should start developing the Use Cases for the project.
Groups
<ul style="list-style-type: none">• Server: <input type="text"/>• Look&Feel(Design): <input type="text"/>• Databases: <input type="text"/>• UML: <input type="text"/>• Scripts: <input type="text"/>• Documentation: <input type="text"/>
Fulfillments/tasks till Monday
<ul style="list-style-type: none">• <input type="text"/> would finish the basic HTML layout pages so that the scripting group can start their work.• <input type="text"/> to give something on learning by Monday• Database group setup tables• <input type="text"/> will complete authentication• <input type="text"/> would generate the road map image of our status till now using MS-Project.
Next Meeting:
Monday the 5 th of July 5, 2004 in ZIM GW2A 4100 at 1400hrs.

Figure 33 : Collaborative Project Interaction: Brainstorming on FLE

Design Challenge

Project work.Student's Life Portal. Proposal

23:13 2004-06-09

Here we go...

A briefly description of the idea.

Contruct a simple web portal to enable students to keep track(subjects, credit points, lectures, uni. life,...) of what the did, what they are doing and what they have do regarding the studies they are involved into.

A Very first draft brainstorming for gathering the initial requiriments.

- C.P (ETCS)
- One access for all
- Courses
- Calender (with groupware function)
- Assignments
- Adressbook
- VAK -name- semester CP (auto include into calender)
- Oral examination
- Collected credits/missing credits (ects student status)
- Rules for fulfilling graduation
- Teacher can see participants
- Document Upload
- Timeline

Figure 34 : Collaborative Project: Brainstorming in pictorial form

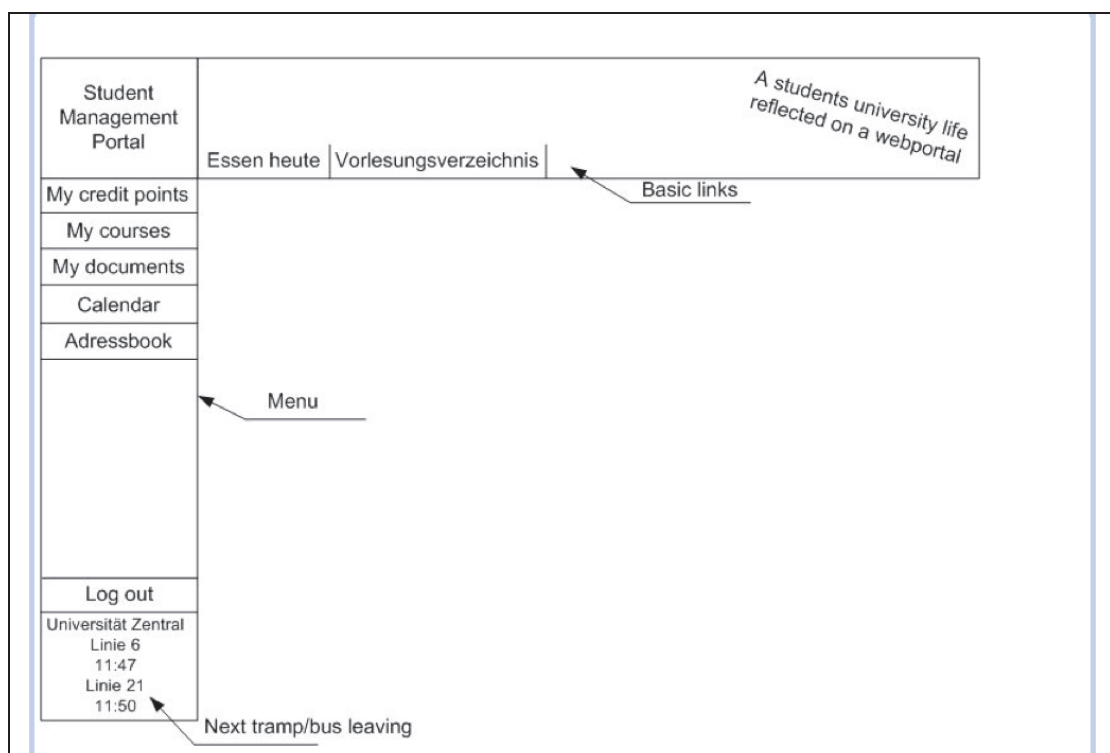


Figure 35 : Collaborative Project Interaction: New Design

The screenshot shows a web application interface. At the top, there is a navigation bar with three tabs: 'Courses' (blue), 'Calendar' (green), and 'My space' (orange). Below the navigation bar, there is a status bar showing 'Bremen 23.26.04 - 30°'. On the left side, there is a sidebar with a 'Logout' link, a 'News' button, a 'Links' button, a 'Forum' button, and an 'E-mail' button. Below these buttons is a section titled 'university central' with several links: 'Essen 1 more', 'Essen 2 more', 'Linie 6 11:47 more', 'Linie 21 11:52 more', 'Linie 28 12:00 more', and 'Linie 32 12:02 more'. At the bottom of the sidebar are links for 'faq | contact us | impressum'. The main content area is titled 'Results for Module 1' and contains a table with the following data:

Modulbereich 1: Grundlagen der Medieninformatik				54 ECTS	
VAK	Course	ECTS	Semester	Grade	
101-1	Mathematische Grundlagen der Informatik	16	WS 02/03	2	
102-1	Physikalisch- Technische Grundlagen digitaler Medien	4	WS 02/03	1.7	
103-1a	Einführung in die Informatik, einschl. Programmierpraktikum	18	WS 02/03	2	
103-1b	Einführung in die Informatik, einschl. Programmierpraktikum	16	SS 04		

In conclusion, we had a final wrap-up session of the course that the large systems are hard to maintain and those integrations are costly and may be striking together in some cases. Since the learning environment framework consists of the system infrastructure, component and application frameworks, it should be designed to meet generic and simple interface. On the contrary, the system should be extendable to create a more specific application and has an open interface to add-on or plug-in a new sub-system. Last but not least, we, however, agreed on the project that it is a difficult and a complex process to unify the campus system, if we still have a legacy system running around campus. Alternatively, we should consider the emerging technologies for learning, like Web 2.0 and Learning 2.0 technology, which can be a candidate-learning tool presently, then plug-in and personalized such tools into the learning environment of any course.

5.4.3. Learning in Digital Spaces

In this section, we explain the experiment on the subject of "Learning in Digital Spaces". Throughout the lecture, the students should learn pedagogical contexts for the development of educational software. We addressed the topics on design software for children as well as for adult education. Students should understand the role of users in the design process and questions of general media, according to the course syllabus in Table 19 (See more information in Appendix A).

Table 19 : Course Syllabus – Learning in Digital Spaces

Subject:	Learning in Digital Spaces
Lecturer	Heidi Schelhowe
Tutors	Milena Reichel (Cricket Toolkit Part) Priyakorn Pusawiro (Dialogue on Tools Part)
Modules	VAK 03-804.50/9
Targets	Digitale Medien, M.Sc. Mathematik/Informatik Certificated Digitaler Medien in pädagogischen Kontexten Informatik, Dipl./ B.Sc./ M.Sc. Primarstufe, LA (auslaufend)
Topic	<ul style="list-style-type: none"> • Important ideas of reform pedagogy (Montessori, Dewey and so on) • Constructionism (Papert et al.) • Learning theories and learning software • Papers from Interaction Design for Children • Education in the knowledge society • Potentials of new media • Learning communities • Vifu, S-A-N as examples • Priyakorn's research - University learning platforms and educational backgrounds
Explore	<ul style="list-style-type: none"> • Tools and Workshops on • Lego Mindstorms and Crickets • Squeak environment • Course management tools for constructing learning environment • Practices dialogue on tools

Course Description

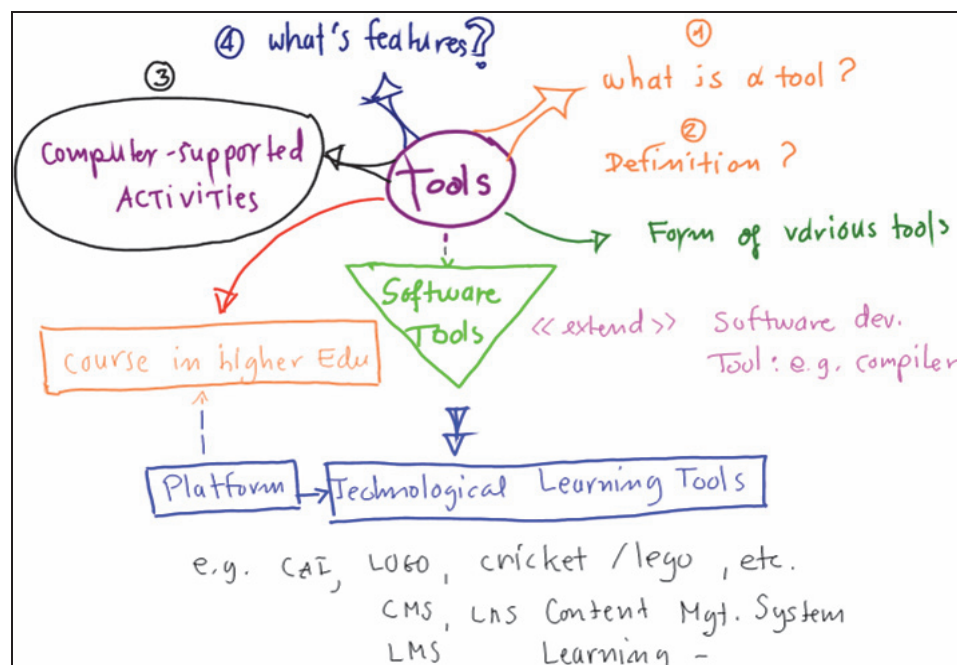
During the semester, students should survey the relevant computer literature and academic papers concerning topics of study. At the beginning of the class, we presented Stud.IP platform and demonstrated how to use it. Later we discussed intensively inside the class and via online discussion inside Stud.IP. We encouraged students to unfold Stud.IP and evaluated the use of that existing software for learning. Finally, students were supposed to design an own piece of software, based on existing tools and software environments.

Concerning exercise and project, students should confirm their ideas how the electronic learning platform or software tools could be used and embedded in an educational context. Students conducted their own research in a small group about 3-4 persons. Finally at the end of the semester, they gave a presentation and handed out a paper that describes the project.

Course Process: Dialogues Process On Tools

Students explored the learning platform and computer tools using the course and analytically carried a dialogue on how such learning tools can empower them to learn convivially. So they discussed proactively about tool components they really used, according to the dialogue step and framework as depicted in Figure 36.

Figure 36 : Dialogues Process On Tools



After understanding the learning software tools and their features, students got to compare and share idea about the tool components and functions of Stud.IP and other tools that they ever experienced. Then students should re-think about the way they used the tools, how often and whether enjoy to use them or not. We sketched the dialogue issues on the chalkboard and start using Stud.IP as illustrated in Figure 37 to Figure 39.

Figure 37 : Dialogues on Stud.IP and other Tools

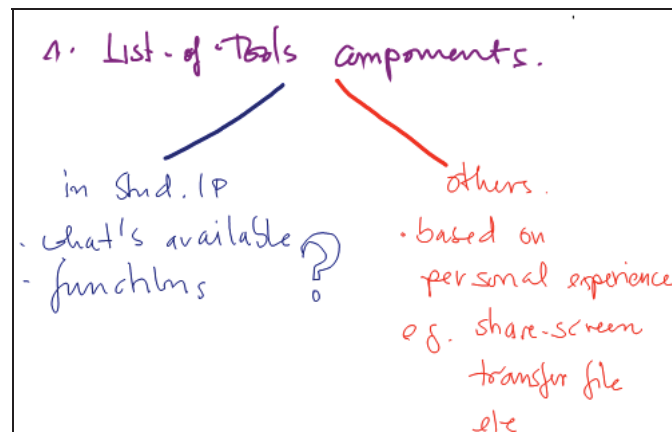


Figure 38 : Dialogues on Stud.IP and Hands-on

when you play around **Stud.IP**
let's **think** about what lies behind it all.

then we will **dialogue** on...

- „computer-supported-learning activities“
- „context: learning about something“
- „learning culture, attitudes and styles“

Figure 39 : Dialogues on Convivial Tools

- When using it → why select it?
 - for what purpose → using it?
 - How often? comfortable to use it?
 or be force to use?

→ if there were other tools in Stud.IP, which one would you like / prefer to use all along the course?

To start discussion and to design the technologies for education, we started introduced the learning platform Stud.IP and then let all students *hands-on, learn to use and experience* by themselves. For out-of-the-class time, students were obliged to use the discussion forum of Stud.IP for their dialogue process as displayed in Figure 40 and Figure 41.

Figure 40 : Stud.IP Sign-on Page

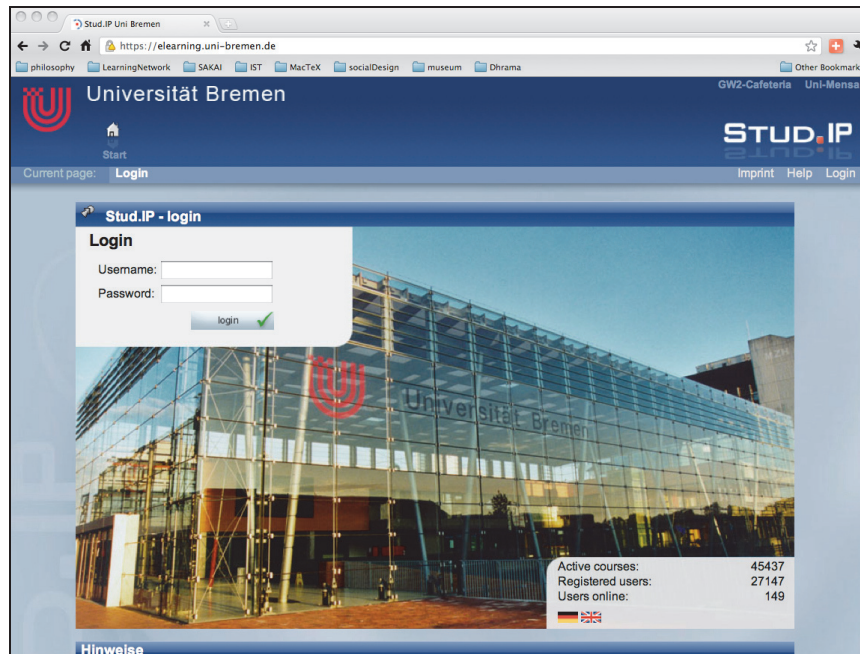
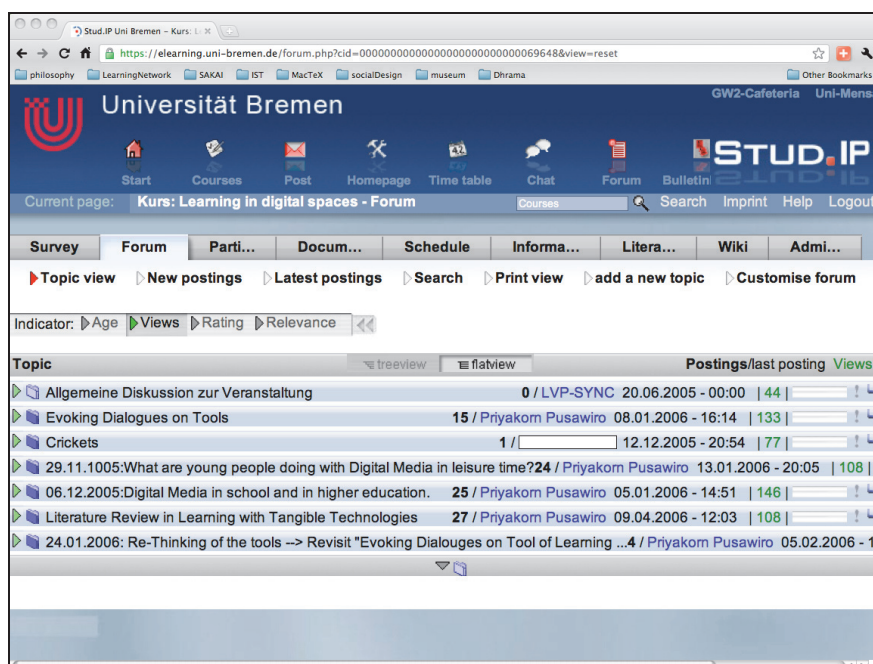


Figure 41 : Learning in Digital Spaces: Course Forum



Class Dialogue on Tools: Reflection on Object-to-think-with

This experiment aimed to question students about their process and understanding in using tools. The reflection process is a key role in thinking about learning. Indeed, tools were used as a metaphor of object-to-think-with. Moreover, students had a workshop on Stud.IP tools and hands-on project regarding constructionist-learning process like cricket and LEGO Mindstorms NXT. After getting familiar with Stud.IP, then students were asked to discover their way for a convivial computer tools, we guided students to ask among themselves about a powerful gadget and further discuss on joyful process as displayed in Figure 42 and Figure 43.

Figure 42 : Thinking about Tools as An Object-to-think-with

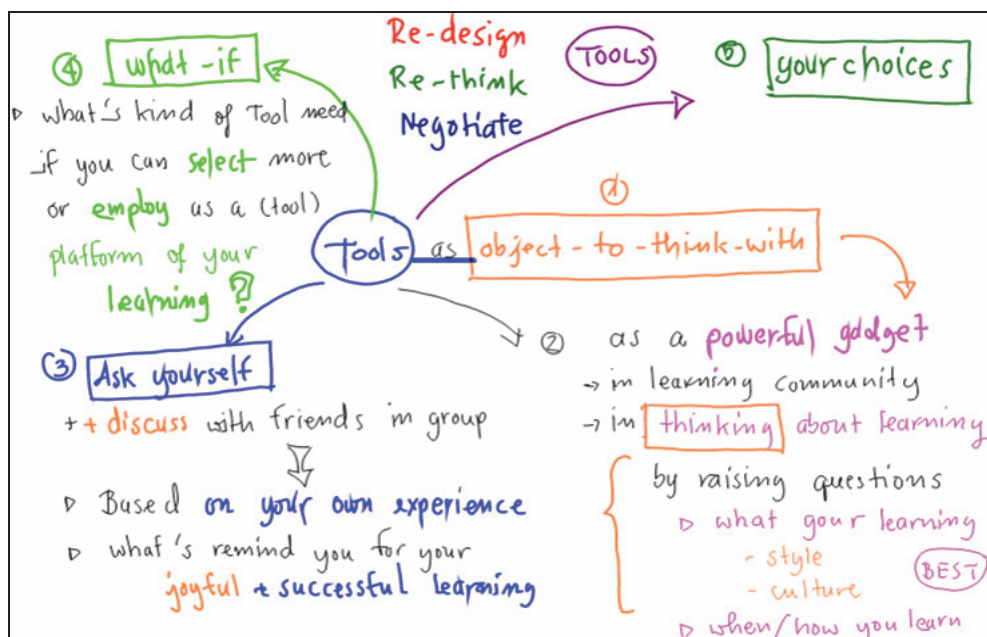
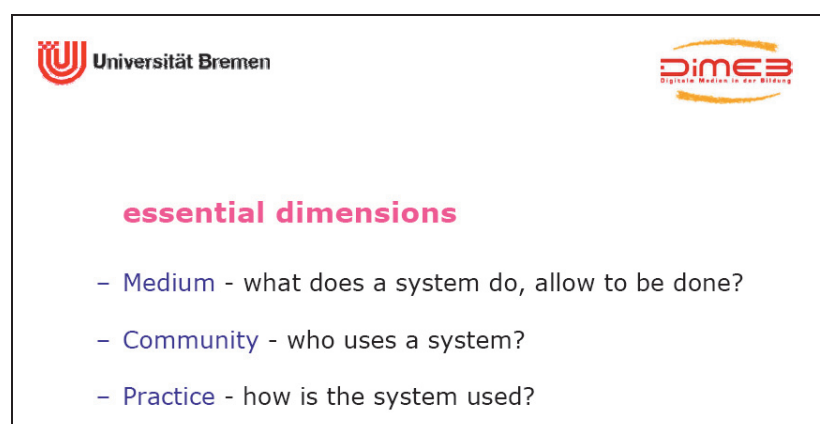


Figure 43 : Thinking about Dimensions of Tools



Course Outcomes

During the semester, we provoked students to dialogues and discussed via Forum in Stud.IP. As times went by students got more experiences on Stud.IP tools and other self-experiences tools based on their everyday life and personal interest. We collected the students sharing message that resulted on “Evoking Dialogues on Tools” and “Rethinking of the tools” as excerpted and depicted in Figure 44 to Figure 50 (see more details of information exchange in Appendix C). The phenomenon and feedbacks are and decoded the key messages as grouped in Table 20 and Table 21.

Figure 44 : Evoking Dialogues on Tools: A start message

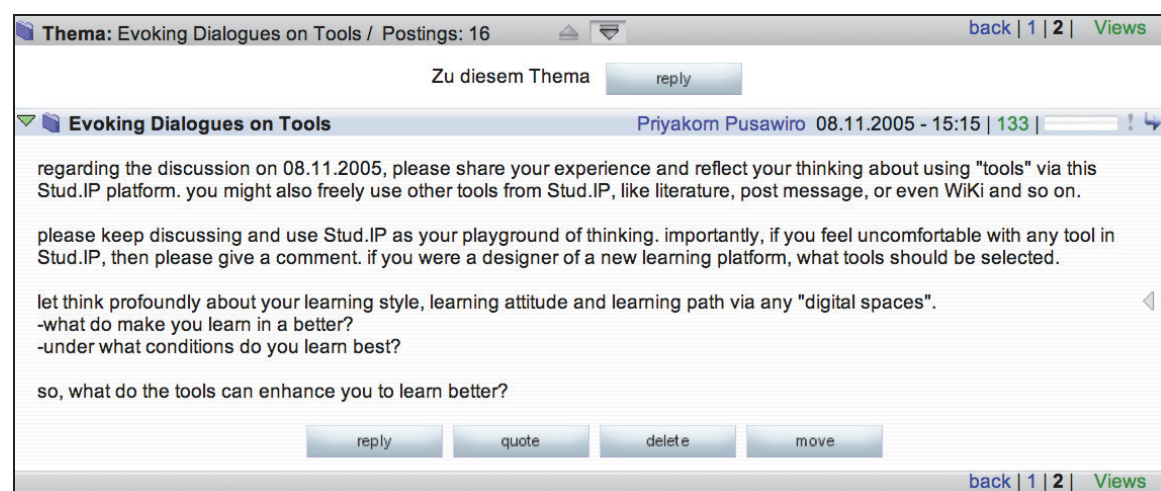


Figure 45 : Evoking Dialogues on Tools: Group Discussion and Post

Re: Evoking Dialogues on Tools

13.11.2005 - 15:59 | 38

We discussed about the topic, the consequences are concluded as following.

I think, the learning platform should provide personal calendar feature, combining all study and personal schedule together. The feature can make easier in time management if users can consolidate personal and study life in the same time. Users can add personal appointment and schedule into the platform. The system would be perfected if the platform's database can be synchronized with other particular program such as Microsoft Outlook.

I think file manager is necessary for the learning platform. File manager is the one tool that makes more convenience for users. File manager includes files uploading/downloading tools. The lecturer can upload lecture notes for the class and let students to download it and learn by themselves before the class. Students can submit their homework by uploading the homework files to the system. They have no need to meet the lecturer and send the papers of homework.

I think if the learning platform has the group discuss function, it will be easier to make discussion in a small group of students in class. Now there is a lot of small group discussion in a class and I think learning platform can help us meet and discuss easily. It will collect all student contacts in class and student can select which one is in the group to make an on-line discussion together. It can also chat, transfer file or even make appointment in their schedule/calendar.

reply

quote

edit

delete

move

's opinion

I think, the learning platform should have a forward message to every email in the course that sends an announcement when the lecturers notice something or upload the document. From my experience I'm an exchange student from Thailand I used to use learning platform just download the document and upload homework and many time I forgot to read an announcement that made me miss the class because they changed room. So I think it's more comfortable if we just check at the email and it's easier than check every course that we took in the Stud.IP platform.

's opinion

Actually this Stud.IP is not so bad all function is quit effective and suitable for student in the course. But there are some functions that will not be used so I think we should remove it, such as Chat room that we already discussed in the class because it will always empty no one going to chat in the chat room in the same time. And I think the Stud.IP's interface is quite complicate so think the interface should be change to something that more easy to understand. It would be much easy to use and I think that more students would be happy to use this learn space. I'm really agree with Sarawut's opinion about to email to every students in the course when there is an update on the learning space. It's the good idea.

Figure 46 : Evoking Dialogues on Tools: Discussion and Feedback

's opinion

I think, the Stud.IP tool may be pretty helpful for a learning community. You can share files and ideas, discuss together, ask something But you do not need to be in the same room, at the same time which is a big advantage. This way, people with completely different attitudes may still work together.

For me, successful learning is e.g. that I understand difficult stuff. Therefore, the tool may help, since I can ask other students for their opinion or about things I just did not understand. Joyful learning for me is to work with nice people and have fun at the same time. Stud.IP allows making appointments with other students, so it may assist joyful learning as well. Otherwise I don't know how it could make learning really joyful.

Something I'm not sure about are the mail and the address book. I don't want another mailbox I have to check and an address book to keep. There's already the Horde webmail from the University and I only use it to forward my mails. All mails seem to be forwarded from stud.ip anyway so what's the point?

There are a lot of tools that I'm not really sure I'll use. I wish the configuration of the page would work better so I could just switch off things I don't need.

I think a learning platform can make the life of the students easier and help not to waste time on searching for the information, files etc. you need. It would be great if stud.IP could do that without annoying me that much.

As a modern university I'd like to see an "all-in-one" system offering the possibility to sign up for courses, to distribute information from the pros to the students, to share information on forums, and so on - not just for a single program of study but for all of them.

Figure 47 : Evoking Dialogues on Tools: Specific Tools Discussion

Re: Evoking Dialogues on Tools

28.11.2005 - 16:27 | 28 |

I think that this tool is very good for sharing information about the studies. Its good because you can find information about available courses and etc. But I'm missing video or audio information. Also it would be good if in this system there would be availability to attend classes through the distance. I mean distance learning. Its good then you are ill and can't attend classes.

information of all courses in one place... I have one more link about my courses... and to this course I have to login... when to visit sites of other

Tool: • a device or or implement, esp. one held in the hand, used to carry out a particular function.
 • a thing used in a occupation or pursuit.
 • computing, a piece of software that carries out a particular function, typically creating or modifying another program.

Figure 48 : Evoking Dialogues: Comment on Stud.IP and Other Tools

Re: Evoking Dialogues on Tools

03.01.2006 - 16:42 | 7

In my bachelors-program I encountered several learning-platforms and collaboration-tools for universities. These included a Wiki (TWiki), Illias, OpenUSSI, Yahoo-Group and Blogs. These system were intended (by the lecturers) to be used for collaboration among the students and better information exchange. But as there were too many systems (two is already one too much!), nobody liked to use them. The students complained about the too complicated user-interfaces and the structure. Every semester some of them tried to redesign the TWiki-System (the only system that was used by more than one professor from my courses) and delivered a new conception.

Let's say some good things about StudIP: 😊
the functionality is very good and extensive - it just would be better if it was better arranged and ordered. anyway it is a good platform to work with and it can be improved a lot and gain to a bigger and much more important platform.

have a nice day

[Last edited by - 08.01.06 - 16:14]

The problem with the learning/collaboration-tools, like Stud.IP, is that they have very high aims that mainly reflect the aims of the system-designers. Of course students would like to have a tool that makes their learning easier and more effective, but in my opinion this can't be done by introducing new and complicated systems. Generally said the Stud.IP-platform has too much functions included from the start, so that the first-time-user will be confused by that. Maybe a good solution would be to offer only the basic core-functions from the start. Each user can then, step by step, upgrade his personal Stud.IP by activating the desired modules manually.

Figure 49 : Re-Thinking of the tools: Review the use of tools

24.01.2006: Re-Thinking of the tools --> Revisit "Evoking Dialouges on Tool of Learning ...Priyakom Pusawiro 18.01.200

Dear all,

Next week after the lecture on Tangible Interface, we will have dialogue again about "tools" of learning platform. We will re-examine the topic on 08.11.2005 "Evoking dialogues on Tools".

As time goes by, I would like to ask you all to re-think about "tools" which you have experienced for several months since we start this course. Regarding "learning paradigms", in particular "Constructionism", we will resolve on "what will be the suitable tools that you would create and employ as your learning platform during the course?"

Please post your idea into the forum of Stud.IP and we will discuss more and more next week.

Kind regards,
—priyakom 😊

Figure 50 : Final suggestion on the favoured tool components


<p>To conclude, I would say that I might need a system like this for obtaining information (assignments, lecture slides, references, ...) and communicating on a textual basis (forum). But I hardly need it to organize my studies (or my day), keep my contacts ordered or get in touch with other people. There are also communication media I would prefer to use (telephone, ICQ, e-mail) to be independent from just a single platform (which might offer similar functionality, though).</p>
<p>I think I would feel more positive to Stud.Ip if I didn't had to use it regularly. In another course where it is just use as a means to allow the professor to give information to the students I found it quite nice to have everything in one place. Sadly the download function didn't seem to work on a lot of the university computers.</p>
<p>I'd like the idea of "Personal homepage". It's good when you can have own space in learnng society. I've added some voting polls and started the discussion. I was really suprised when people started voting and discusing. It's really good chance to find some new freinds or disccuss about your studies.</p>
<div><div>▼  Re: 24.01.2006: Re-Thinking of the tools --> Revisit "Evoking Dialouges on Tool of Learn... 05.02.</div><div><p>After 3 months that I've used Stud. IP I think it's a very good learning platform because there's a lot of tools that let user used it. But the problem is it's to complicated to use. The main thing that I want in this platform is Center Message.</p><p>For the tool we think that should be in the learning platform is Center Message. It's like you no need to go to every page of courses that you attend to read an announcement or see the change of the forum that you posted. Center Message will show the changing in each courses that make everything easier than go to every pages of every courses to see it. Because I think most of student log in to this platform about once or twice a week. so it's more comforable if it's a Center Message or eMail alert.</p><p>And I think this tool will make me more comfortable and easy to participate with other people.</p><p>That's my opinion.</p><input type="text"/></div></div>

Table 20 : Phenomenon and Feedback: Must-have Tools

Preferred characteristics	Must-have Tools
Easy to use and navigate at glance	News and announcements
Simplicity	Information exchange
Usability	File manager, File sharing
Comfortable	Upload and Download
Friendly	Syllabus page
Enjoyable	Materials and slides download
Joyful and Have fun	Group discussion
Motivate in learning	Collaboration tools
Promote learning together	Student list and Who-is-who
Keep discussion alive	Inbox and email
Social connected	
Not too much tools	
Not being forced to use	
Handy	

Table 21 : Phenomenon and Feedback: Should-have Tools

Preferred characteristics	Should-have Tools (Optional)
Nice design and Look good	Calendar feature
Get help for others easily	Personal schedule and Time table
Customization	Course administrative
All-in-one	Organizing the course
Lucidity	Submit homework
Ergonomic	Video and audio access
Informative	Email synchronization
Successful group work	Organizing your studies
Be able to revisit the former access content	Grade view
One platform at university	Print preview
Single web presence	Address book
One-point access	Forum and tread message
Practice face-to-face	Chat room
Single sign-on	Blog or WiKi
Communication channel	Search engine
	Workgroup Tools
	Mailing list
	Weather forecast
	Mensa Menu

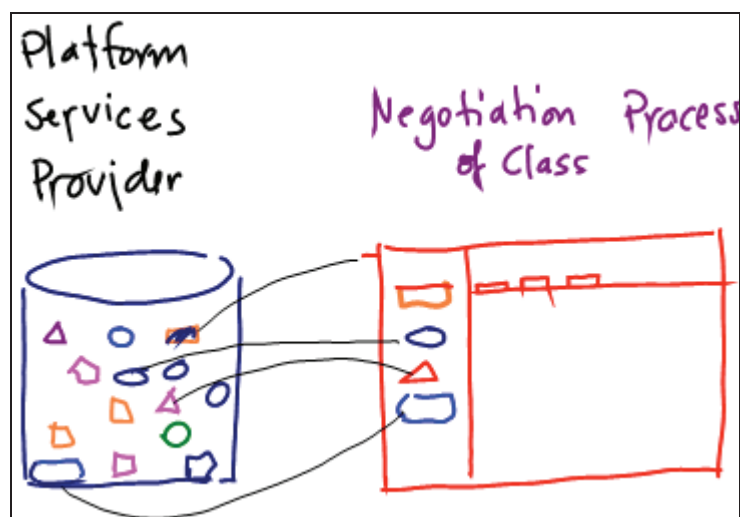
Choices and tools selection for constructing the learning platform

In dialogue process, when we discussed about the tools and the learning platform based on the following aspects:

- What are the appropriate components for constructing the learning tools?
- What kind of tools is needed to support students in learning process?

After analyzing the forum message and observing the class discussion, although, there is no complete solution for the best platform, this experiment suggested an alternative action that may be helpful in enabling learning to happen. We found that the forum have a result related to our assumption about the convivial tools, as we see the keyword, for instances, happiness, joyful, easier, comfortable, nice and in-control.

Figure 51 : Tools Selection Idea

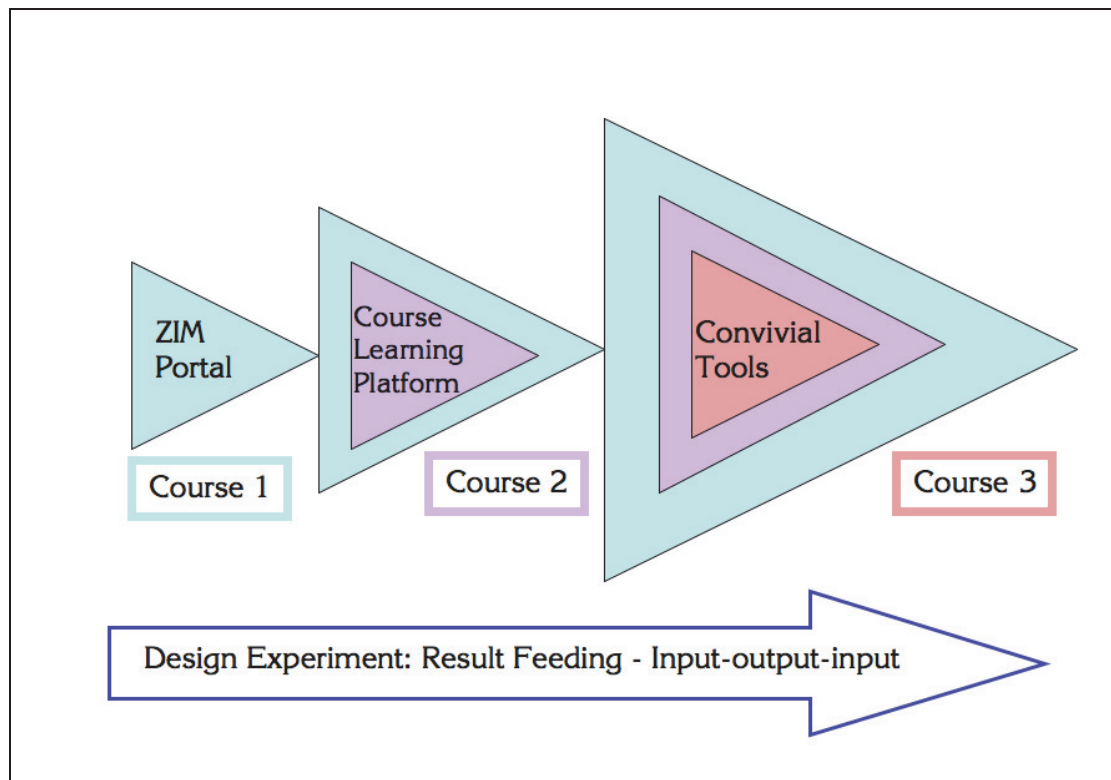


We all come up with the solution that we should have the chunk of tool components and gadgets, then convinced participants the process of tool selection and negotiation at the beginning of class as shown in Figure 51. In that case we all agreed to the dialogue process in order to get awareness on using tools that based on our customary choices.

5.5. Conclusion: Evidences and Results

The experiments and evaluation method of this study is influenced by design experiments [Brown, 1992], which shows the way to incorporate learning innovations and technologies into constructionist design process. In the case studies, we continually implemented the experiment into a series of research cycles. The results of previous experiments then served as references for subsequent case studies. Brown recommended this methodology to ensure that the research and results represent the big picture of learning environment and can measure the impact of learning technology. The selected learning environment in each case study captured user actions such as usage patterns, attitudes and tendency in using tools. Moreover, we combined the informal observation techniques and monitored what happened during the online discussion and face-to-face dialogue in the classroom as illustrated in Figure 52.

Figure 52 : Design experiment research cycle



During the course, students presented their progress to the class and regularly posted messages onto the forum. We asked students to discuss the assignments and project work weekly, to achieve the critical thinking skill. All students were required to read the course materials for the weekly discussion, which was conducted online, and at face-to-face meeting. Afterward students were required to write an analysis, post idea and comment online for the entire class to discuss and then submit the assignments via the learning platform.

Lesson learned from the design experiment is to use technology rich environments effectively in order to connect to powerful ideas. However, we explored more deeply after case by case about how we can facilitate that learning with the link to personal experience in using technology. The result of the case studies experiences to integrate student, teacher, university and community together and then combines those elements with technological environments.

Conclusion

We found that, in the first case, lack of appropriate tools and motivation resulted in low communication and information exchange in the class. By force, this could not be convivial. We instead encouraged students to negotiate and use the learning management system in the second and third experiment, to see how motivation could be enhanced.

As our focus was on constructing learning environment, namely pedagogical collaboration; learning how to learn; interactive learning; and idea sharing, we found that students used online discussions as a supplement to face-to-face discussion. The forms of interaction such as forum and message posting forced students to reflect on other perspectives and restate their arguments or even counter arguments. We gained insight that the discussion thread had been used in order to improve information exchange and knowledge construction during the project work.

Evidences showed that students used platform not only to share the project idea, but also to learn the course content via learning tools. They used the communication tools to share information, learn content, negotiate argument and give ideas about the group project. We found that students also implicitly improved themselves in the areas of discussion, reflection, and feedback. If a ready and convivial tool exists, such would enhance collaboration and interaction

Most of networked learning researches are aimed at studying the characteristics of a collaborative learning community. In this work, the focus is on the characteristics of social networking community, precisely how underlying social learning influence the constructionist approach. We studied the social involvement and educational learning webs and attached underlying social learning into constructionist approach. We found that the class activities must be personally meaningful in social context. Activity, motivation and reflection of the learning process are positively shaped by networking and social circumstances.

Learning Environment: Students, Teacher, Computer and Classroom

There are evidences that learners are always subjected to influences from social and cultural settings, and the results of shared knowledge could be creative and positive. Results on both students and teachers were observed, to learn how the learning environment contributes to the creation of a convivial computer tool for higher education. Significantly, when creating the friendly learning environment, either virtual or physical setting, apart from the roles of students and teachers, we must consider the following components: architectural floorplan, the layout of the classroom and physical equipments like chairs, tables, computer and network gadget and finally the social and networked atmosphere. Relevant findings and results of *"Constructing the Learning Environment"* and *"Convivial computer tools"* will be contributed in the next chapter.

6. CONSTRUCTING THE LEARNING ENVIRONMENT AND CONVIVIAL COMPUTER TOOLS

The overall aim of this research is to encourage faculty members or lecturers to design and deploy the right learning environment in a principle way, which means uncovering the conjecture about the role of technology for learning. In case studies, we explored each course via empirical research and participatory learning. After we presented students the sample step and guidance on how to construct the learning environments that foster the learning and teaching process, then we observed the cases via the design experiment method. Through the pedagogical design, we have seen that there is a must to adopt the right theory of learning whenever using any computer tools. This is also the case for designing convivial educational tools.

According to chapter 5, the use of technology may support students to interact with each other in learning a subject matter, however, the role of the technology is principally to enhance students to learn collaboratively either with the conventional teaching method or a creative one. There is actually no single model in constructing the learning environment for higher education. We, however, seek for an alternative solution that enhances the classroom learning. Certainly, there are benefits of using technology to achieve better learning outcomes. The more important is to be clear about underlying learning assumptions that we bring into the classroom.

In recursive design experiment, we explored various learning patterns that would enhance an interactive, collaborative and personal learning in order to empower students for their value of learning and foster the construction of a convivial computer tool at university. Thus within this chapter, the evidences and results are summarized in relation to the overarching research questions posed in this thesis:

1. How should educational tools look like to become convivial tools for higher education in order to enhance an interactive, collaborative, and personal learning environment?
2. How can electronic learning environment in higher education be used to raise awareness and foster constructionist learning?
3. How will participants — students, teachers, and tutors — be encouraged to effectively interact with each other? How will they network and share common classroom activities?
4. What procedures are needed to ensure the effective use of tools in classroom and how to organize these tools to fit, but not to force, a student's use?

Through observation and analysis of the case studies, we developed new approaches that facilitate the design of convivial tools for higher education. Focusing on the users of the learning platform, the rest of the chapter we describe how the electronic learning environments can be used and what procedures are needed to ensure the effectively use to interact and collaborate in classroom. The results of this thesis and the scenario explanation of constructing the learning environment with the convivial tools can be summarized in Figure 53.

Figure 53 : Components of learning environment and convivial tools

<p>Constructionist learning environment</p> <ul style="list-style-type: none"> • Construction of the learning platform • Student-owned technology • Innovation process via digital tools • Project-based learning and tools • Co-construction the environment • Reflection and practice • Motivation in classroom 	<p>Students, lecturers and learning</p> <ul style="list-style-type: none"> • Learning styles • Type of learners • Learning approaches • The roles of learners and lecturers • Learning environment • The roles of the learning culture
<p>Classroom setting and learning site</p> <ul style="list-style-type: none"> • Classroom environment • Classroom setting • Classroom activities and guideline • Classroom procedures • Common room • Alternative place for learning • Face-to-face contact • After classroom learning • Room layout 	<p>Convivial computer tools</p> <ul style="list-style-type: none"> • Dialogue on digital tools • Negotiation of convivial tools • Agreement and choices • Constructions reflection process • Design of learning environment • Technology integration • Willingness, happiness and joy

6.1. Constructionism: Environment and Participants

6.1.1. Constructionist Learning Environment

To answer the research assumptions, this section presents a holistic view of constructionist learning research that associates to the knowledge from the learning theories and the technological practices as discussed in chapter 2, 3 and 4.

Constructionist learning environment itself can be seen as a tool that participants learn to perform the actions and undertakings for their learning. In learning environment, the learning occurs by knowledge sharing and dialogical process. Meanwhile, the interaction occurs via the process of sharing, discussion, reflection, and refinement. It is a cycle of learning, moving back and forth through phased of externalization and internalization.

The constructionist perspectives is emphasis on learning-by-doing and through problem-solving activity. Students got to manage the task and solve the problem. When setting up the project in course, it is so crucial to create a sense of ownership of the task to students. As a result, students have a sense of belonging and get an opportunity to reflect their own learning.

As to constructionist approach, the design learning happens when students are active participants in design and share activities that give them a sense of control over their learning process. When this learning takes place within the group, students are encouraged to share what they have constructed with others. This is a social learning experience. Within a constructionist collaborative environment, students share not only their constructions but also their constructed knowledge within the community, which leads to improve the individual learning process. This is personal learning experience.

While the constructionist idea for designing the learning environment can promote student-centered approach, group work and social interaction, using convivial tools in classroom may stimulate the students to be able to share their ideas and information energetically.

A pedagogic gain in using digital tool is the blended learning or a hybrid teaching-learning environment where conventional lectures and web-based learning are combined. In coursework, students may share understanding via the network environment, like social networking webs. They may create and post their idea into the community. Such network community can play an important role in the dissemination of knowledge in a form that everyone can use and benefit. We relate this connected to the learning webs (by Illich and see more in section 2.4) that people learn what they need from whomever they need whenever they need it most.

Because the constructionist approach aims to empower communities of learners to share what they know to others and then feedback and think aloud to community, the communication in constructionist environment may boost up students to become active and be self-directed learning in the learning webs community. The available digital technologies and tools are served as artifacts for their learning playgrounds.

Nevertheless, in higher education, to cultivate the constructionist procedure into the classroom process is a challenge for constructionist learning designer. We found that the idea of “constructionism” and “object-to-think-with” is really useful. If possible, we suggest teachers to make use the following powerful class procedure, according to Papert.

- Making thinking explicit via project (artifact)
- Making reasoning and its consequence visible via presentation
- Fostering effective problem solving and planning skills
- Learning to learn from errors (debugging skills)
- Developing reflective skills

6.1.2. Classroom Setting and Learning Site

The dialogue process supports students to share multiple perspectives into the learning environment, that process allows student to have more understanding about course content through the interaction with other classmates. It is subject-object interaction. We, therefore, recommend that the classroom process should create this active learning environment to promote interaction between subject-object and students.

We found that dialogue can empower learners and facilitate the development of learning relationships between students in constructing the learning environment. To support the development of learning to learn, we suggest in Table 22 that before we start the course, it is important for lecturer to prepare the following actions and practices of teaching and learning clearly.

Table 22 : Action and practice in the course

Concern To-Do	
Action	Set out a clear activities and interaction process
	Clarify goals and feedback to all participants
	Understand the student performance and pathway of learning
Practice	Set out interactive environments
	Support for reflection
	Set out the environment in social practices
	Practice enquiry and learning to learn
	Inject the dialogical process and collaborative learning

The role of electronic learning platform may enrich both individual and group learning experience. Either personal or social learning environment does a given action. Based on the evidences in case studies, we recommend faculties member prepare the clear course syllabus, set out a convivial atmosphere and well prepare the pedagogical guideline for constructing the learning environment before the class begins. We concluded what we found and still affirm that the deployment of the platform should be augmented to learning design as guided in Table 23.

Table 23 : Pedagogical guideline for designing the learning environment

Guideline	Process Description
Situated learning	Clarify content, agendas, goals, tasks, and assignments
Group dialogue	Encourage group interaction and social networking exchange
Content reviewing	Recap prior knowledge before introducing new subject matter
Information sharing and thinking	Persuade student to argue, debate, investigate, and asking questions collaboratively.
Idea demonstrating and project presenting	Provide a slot of time for students to show openly what they have learned and done
Learning awareness and personal reflection	Empower students to think about their learning and synthesize their personal learning

Soon after, at the beginning of the course, all participants – students, teachers, and tutors – should clearly discuss and think about their thinking and learning, before continuing the class activities and using LMS or MLE platform.

Since we claimed that constructionism encourages thoughtful reflection on one's learning experience, through the experiment, we found that the constructionist environment can support explicit reflection via object-to-think-with, from intangible to tangible knowledge, and then students can demonstrate their learning and understanding via sharing project pervasively with other students. Accordingly, students learn to solve the problem and aware to recap their knowledge. It is a circulation process of dialogue, feedback and reflection through the dialogical process and collaborative learning.

As to the academic models in the case studies, we let student share ideas actively in a classroom or by posting message online. Therefore, students should actively and regularly read course material. This way of learning demands retains student to discover the facts and then create their understanding for the knowledge sharing in project. Also, they practice the social negotiation via collaborative and interactive processes; insofar student learns to argue their own perspectives.

According to constructivism and constructionism, both approaches deliberate students to construct their idea and share their project and knowledge with others. Indeed, students train themselves to develop their minds and selves both individual and social circumstance. In regard to the classroom experiment, we designed the classroom atmospheres to fit in those learning theories and open a chance for students to convey their knowledge, attitudes, and interests to other students. When students incrementally exchange their opinion, give critics or listen to comment, they can develop their ability to reflect on there own thinking through these practices.

To enhance the informal discussion in the course, we gained experience from a just-in-time learning experiment that the classroom design and atmosphere should be set up appropriately and comfortably to empower the interaction and collaboration inside the classroom [Pusawiro, 2006]. The following lists are the selected techniques that we applied to our classroom experiment in order to make an energetic class.

- Tailor-designed classroom both desks and chairs such as ring shape
- Bounce idea and Brainstorm
- Recap the last argument
- Free discussion and conversation
- Rapid feedback and informal debate
- Share project sketch
- Learning from friends
- Teaching something to friends
- Regular presentation
- Take short note and write a diary for a memorandum

At this point, we have seen that the electronic learning platform can be used to support the dialogue and reflection process during the course. Computer can capture and keep record the messages or chat of the course. The exchanged content can be saved in the course database and be available to review and reread anytime. We can even search former idea to review or compare to the new one. For example, in FLE platform (see more in section 5.4.2), students could access the knowledge forum, see all thread conversations and then select the useful information to their common project. At present the computer tools play a significant role for collaboration and interaction.

6.2. Tools for Conviviality: Tools, Users and Environment

6.2.1. Convivial Computer Tools for Higher Education

The traditional classrooms provide a particular form of student-teacher relationship such as frontal teaching that teacher talks most in these classrooms and student engagement is limited to raising hands or just listening. This is one-way learning. When a networked learning environment comes forward, however, this may create a new form of relationships that link the student to peers and experts from around the world, not limit only at the university.

As we commonly known that the MIT OpenCourseWare (OCW)³⁰ provides the academic resources from different institutions and educators. It aims to unlock knowledge and empower minds to all learners. The open educational resources can provide learners with a huge pool of resources; therefore the knowledge can be accessed from everywhere. We have seen that students have a good chance to learn academic knowledge anytime. These digital content can persuade students to explore their interest and share their understandings via global learning network. As a result, such courseware gives a free choice for students to learn based on their curiosity with digital technologies. Certainly, this is a learning webs topology of both people and content.

In fact, we have seen that many universities install LMS or CMS into the existing classroom, but they still use it with the conventional teaching and learning. This old style of classroom has less innovation of using such technology. Nowadays, the state-of-the-art Web 2.0 and social software can construct a new space for learning and empower the mode of interaction. Hence, we should find a creative way to use them conveniently and efficiently.

³⁰ MIT OpenCourseWare (OCW): <http://ocw.mit.edu/>

What we pay attention to is profoundly influenced by making tools together in collaborative project (see section 5.3 and 5.4), the project was served as a common activity and tools were served as an object-to-think-with in the project. Throughout this thesis, we pay attention to the uses of media and digital technology in education, how to deploy the learning technology as a convivial tool and link it to support a powerful ideas. This is also a challenge for all faculty members.

Powerful media for expression

Computers can be used as an exterior to project and express aspects for collaborative work. Thus they can serve as a collective information space for the learning activities. Furthermore, computer can engage students in working or fixing something together, and then students can share ideas and keep record on what they work together. At the end, they can present and express their idea collection that kept posting onto the learning platform.

Powerful media for collaboration

In fact, the computer can support discussion of ideas in both synchronous and asynchronous ways. Computers provide the possibility of making the project assignment easy by logging everything that is said and done in the electronic learning environment. By analyzing these logs, we are capable to see the development of students, evaluate their experience and then observe changes over different periods of time.

Supporting communities

Similarly, networked learning environment allows users to form a community of learners who share similar concerns or issues via learning webs. This enables social support as well as augments to face-to-face communication. We accept that the social networking gives students an opportunity to collaborate together in projects in very different ways rather than in face-to-face situations. Since some students have already acquainted to share information on the Internet, this medium can possibly create a trust zone for their idea contribution.

Accordingly, we found that sharing the multiple viewpoints via convivial tools may help students to form their own perspectives and learn to be communicative and interactive. Students might meet later in a common room or physical space to foster their relationship. For this reason, the information sharing can happen both ways.

6.2.2. Role of Computer in Culture and Society

New generations spend many hours using computer applications for educational, entertainments and social activities. We have seen the potential of social software tool here. We may also offer students to use the social network applications that provide the opportunity to engage their learning. Nowadays, students can learn ubiquitously via mobile devices and applications, though it may not be successful in all cases. Consequently, we recommend designing and constructing the computational environment that propose a shared learning space with social networking in order for students to learn convivially and think internationally in higher education level.

It is commonly agreed that the ability to form a networked learning and extend the resources of knowledge to the world is a new quality of new generation. Therefore, we should not detach emerging technology from the former computer tool. Indeed, if we co-construct tools with the right pedagogical design, both can have an impact on learning. It is a power of technology in education that can connect learners together and encourage interaction, discussion exploration, and collaboration. We see this is a challenge policy for higher education.

Social Software

As we implemented the action research via project-based experiment, we get insight from the personal experience that social networking software can be an option to design a new model for learning environment. The emerging social network community may invent a new phase of development educational technology for higher education context. It is commonly seen that learning is integrated more or less in a social context either in physical classroom or in virtual learning environment. We see the emerging technology is not only at hand but also enough to engage students in learning, link them to the source of social ideas and reinforce them with social network environment. The evidences imply that students get involve to learning community informally, meanwhile, they engage into teaching and learning, student-student interactions via the use of various technologies.

Regarding the design experiment, we found that the case studies inspire the design of innovative learning environment that support learner to create activities and co-construct the new way of learning via collaborative tools or groupware. That means students need software designed to support their information sharing, message exchange and co-operative effort. They need a tool that enables them to work together. Thus, we underpin the social software as a convivial trend for the sake of collaborative and interactive technology for MLE in higher education. In Table 24, we recapitulate the preferred characteristics of computer tools that students would like to include into their personal learning environment.

Table 24 : Preferred characteristics of computer tools

Preferred characteristics	Must-have Tools
Easy to use and navigate at glance	News and announcements
Simplicity	Information exchange
Usability	File manager, File sharing
Comfortable	Upload and Download
Friendly	Syllabus page
Enjoyable	Materials and slides download
Joyful and Have fun	Group discussion
Motivate in learning	Collaboration tools
Promote learning together	Student list and Who-is-who
Keep discussion alive	Inbox and email
Social connected	
Not too much tools	
Not being forced to use	
Handy	

As to the survey of learning environment and the software trend, it is, however, unclear what exact tools is the most appropriate model for constructing the learning environment. The candidates' technology ranges from learning management software for the whole campus, like Elgg, Sakai and Stud.IP, to social software for personal learning, like Facebook and mySpace, which focus primarily on social tools not the whole university platform.

In summary, it is possible to consider just a single tool or a large learning environment model. The selection of tools is depended on the subject and method in the class, for example, lecture-based or projected-based and in small classes or in broad classes. We have to make it clear when designing the course, method, learning style, and approach activities in classroom. Last but not least, students should not be forced to use the tools, but they should feel comfortable, enjoyable and ready to use such tools. Let them choose their PLE and commit to use tools by themselves.

6.3. Constructing the Learning Environment

In constructing the learning environment, the contribution of this work describes how technology would achieve to support the reflection of the learning process. This section recaps the way we map the underlying theory of “*Constructionism*” and “*Tools for Conviviality*” to the design of learning environments.

The project that students designed the learning portal or MLE together reflects the creative activity that students could participate and share experiences together. The new learning environment is co-constructed by participants of course. It is learner-centered direction and participatory design process.

In former section, we explained the way learners learn interactively to develop their learning experiences through the reflection process. We affirm that teachers should unpack the learning theory and make clear about learning method that will be used for teaching and learning in the classroom. This is the essential stage to form the activities and instructional approach, when constructing the learning environment. Indeed, we are now in position to give a suggestion how to synchronize the technological tools into the theoretical education – conviviality and constructionism, respectively. The technology-enriched learning environment provides a starting point for deeper reflection about learning.

6.3.1. Classroom Process: Activity-Design

The educational procedures that we proposed earlier depict a scenario that students engage and learn interactively in meaningful tasks, and then students share their learning interest and give feedback to classmates and teachers. Vitally, students can reflect their own understandings and communicate interactively with colleagues through dialogical process. The activities in classroom should foster students to use tools using an agreement process, particularly a dialogue process, as presented in this work. When using digital tools and electronic learning environment, teachers should observe and escort students along the learning process in order to foster interaction and boost motivation to learn. On the other hand, students should keep posting their idea and tracking the knowledge they gain in order to raise their learning awareness, too.

The basic understanding of education and of technology-supported learning is the key to design the technologies for education. We recap the case study that we let student hands-on, learn to use and experience on “Stud.IP platform” (see more in section 5.4.3). During the semester, students kept discuss and share idea via Stud.IP. They commented and criticized the good and bad point of using that platform, likewise we kept posting message in the forum intensively to maintain an active participation atmosphere. We have seen that it is the important role of teacher or facilitator to keep discussion alive and provoke students with different kind of questions. For that reason, to create the process of “Learning-Making-Taking-Knowing-Sharing” in classroom, we learned from our design experiment that we should concern the following aspects:

- Selecting and using tools
- Happening in the classroom
- Teaching technique
- Learning process

Moreover, to create a successful collaborative project, we learned from the case studies that we should inject class process the following activity-design:

- Engage students in concrete projects
- Create teams
- Promote teamwork on their own direction
- Design activities that foster collaboration
- Rely projects on collaborative technology and share idea
- Motivate participants to interact regularly
- Provide leadership
- Keep postings short and focused
- Label contributions meaningfully
- Allocate resources and share knowledge
- Promote students learn the right information
- Promote students to get material upon priority

6.3.2. Classroom Design: Student Engagement and Involvement

Additional issue is student engagement. When designing activities in the classroom, we should keep in mind that students come from different learning background and experiences. Concerning learning approach, some students wish to interact socially with others; on the other hand, some wish to learn in person. It depends on their learning styles. When selecting any tool, we should encourage students using that tool sociably and instantly throughout the course, because students should not leave out during the classroom process. Essentially, we should concern those issues to maintain student engagement.

Another issue to consider is the dialogue in classroom – the interaction between teacher-students and students-students, such process really empower and support group learning based on either individual constructionist or a socio-constructionist approach. Importantly, students should have chance to select and negotiate their learning tools that we offer to them. The co-selection of appropriate software can support them to be an active user. As long as they fluently use the digital learning tools, then they become an empower users. So, students shift from passive learner to active learner. We have seen that students become an active creator of tool-enhanced learning rather than passive using tools provided by university when we embed the following constructionist principles in to the classroom.

- Focusing on constructionist activities
- Encouraging students to work on projects
- Creating a sense of community
- Providing resources and opportunities
- Giving students greater control over the learning process
- Making the learning more personal and more meaningful contexts

- Engaging students in authentic and multidisciplinary tasks
- Participating on interactive task
- Working collaboratively
- Grouping student heterogeneously
- Learning through exploration
- Facilitating instead of teaching
- Thinking about learner's ownership
- Fostering creativity by introducing new resources and activities
- Creating an unstructured and friendly learning atmosphere.

The constructionist approach aims at thinking about the tools that enhance learning. Tools serve as object-to-think-with or artifact. If student feels comfortable to use them and be able to use tools efficiently, this feeling can create a sense of owner to students. When students feel not to be forced to use tool, during the semester they may convivially interact and share idea into the course via such tools. To enhance the class activities, the convivial computer tools should implicitly empower students the powerful ideas.

To end this section, we suggest engaging students into the technological learning environment that enable interaction and collaboration. When students found their convivial way to use tools, then the tool turns to be convivial for them. Therefore, we should design the innovative and creative uses of educational technologies convivially.

6.4. Conclusion

This work introduces the concept of constructing the learning environment; we see the opportunity to deploy a social software tool into the classroom. The consideration might be the strategic integration process and the university policy.

We have seen in the design experiment that the educational technologies are a key of success to enhance learning. The primary role of technology is collaborative and interactive communication platform. If we encourage students to use tools regularly, the computer tools can link students to social context, to other knowledge network and sources of powerful ideas.

So when thinking about convivial tools, we should perceive the holistic educational view of using tools within the learning environment rather than a discrete element. Because such environment is not only composed of students, teacher and tutors of the class, but also included social, community, physical space, and learning infrastructure. In other words, we should consider all elements that technology may glue them and help integrate a big picture together in order to empower learning and powerful ideas.

The role of learning tools is served as an object-to-think-with when class participants co-select and use tools. The students benefit and experience the externalization of personal idea via exchanging information. The dialogue process reflects the act of thinking aloud among students.

Referring to the classroom experiment, we affirm that we should include social practice into the classroom process in order to augment the involvement of student to the class either via face-to-face and online learning. Thus, the concept of blended learning – a mixing of different learning environments – is a sound method for higher education.

In conclusion, to provide a choice of tools for a group of learners, in the future, we expect to gain a deeper understanding of a practical use of available social software in order to establish and sustain the constructionist-learning environment and blended learning in higher education.

7. CONCLUSIONS AND DISCUSSIONS

7.1. Recapitulation

Throughout this research we explored the learning practices and the use of technology in higher education. To find evidences, we experimented with the project-based learning activities and constructionist learning concerning three courses at the University of Bremen. In each case, we investigated the classroom interaction via a participatory software design and dialogical process in order to observe how participants share their idea about constructing the learning environment, particularly computer tools, in the classroom. The following conclusions can be drawn from the study.

Most universities today rely on different learning software applications. There is an attempt to integrate various available tools into one learning portal and single sign-on. However, students have shown less interest in using official campus learning software for communication and information sharing, while they appear more comfortable in exchanging ideas informally via simple social software site like MySpace, MSN, Facebook, Ning, BigTent and so on.

Of course, we know that there is no a one-size-fits-all solution. We, therefore, call for a rethink of the educational process towards blending together commonly used Internet tools and educational tools rather than developing new tools for the classroom. In case studies, we convey the importance of tool selection, either the legacy or the emerging tool, and found the effective way to fit a learning tool into the right learning model, when the learning platform is used for the classes. Thus participants, mainly students, can really use such technological learning environments to enhance their interactive, collaborative and personal learning, when needs must.

We seek to embed the constructionist-learning context into the higher education environment in order to promote active learning and encourage students to construct their own knowledge expressively. The underlying philosophy of Constructionism considers the software platform is not only a tool, but also as a potential carrier of new ways of thinking about teaching and learning for our education. In doing so, the lecturer should change their roles to facilitator and collaborator as opposed to information provider. The faculty members may become a mentor and should be able to accommodate different kind of learning styles.

We proved our assumptions by conducting the classroom experiment. The projects and explorations were set up to engage students into the interactive and collaborative learning environment. In other words, classroom activities are more focused on self-directed with meaningful project. Thus we intervene students from time to time in order to lead them the right actions in co-constructing the learning environment.

To co-construct the learning environment or select the computer tools, the evidence from this study suggests that the driving force behind the learning awareness is discussion, negotiation, and reflection via a dialogical process in classroom. As seen in the design experiment, we did start such processes at the beginning of the course syllabus. As time goes by, students prove that they engage into the reflection process by posting message and sharing idea into the discussion forum. These activities raise awareness for their learning and thinking process.

7.2. Conclusions

This work also attempts to discover the most effective techniques for designing the learning environments and to apply the convivial computer tools that can deliver the content to students effectively. When new media, like social software tool has been introduced to the digital world, there is always innovation effort for using that tool in education technology. When we think about digital media technology as computational tools that may enhance an interactive, collaborative and personal learning, it is important to understand the objective of the educational software in order to apply them effectively in classroom.

Since we aimed to boost up the motivation and involvement of students in classroom, we encouraged them discussing and having dialogue regularly. As long as students keep pace themselves to interact with tools and classmates, it shows that students identified themselves to be member of class, then they keep practice themselves to be an effective, life-long and proactive student.

In the class, students change their roles from a participant to a creator of the ideal learning environment project. It conveys that students gradually turned themselves to be a tool designer or selector for the learning environment. This evidence proves that students are ready to opt for their favoured tools.

One unanticipated finding was that the computer tools, as powerful tools, should be able to use intuitively and simply. When choosing a convivial tool, we should feel no clumsy to navigate and control them.

Taken together, this thesis proposes the learning procedures, classroom settings and sociable factors in the deployment of educational tools, according to Constructionism and Conviviality idea. It is important to note that instead of developing a new learning platform, this research focuses on the discussion and negotiation processes to achieve at the design selection of appropriate classroom tools. In order to enhance the classroom-learning process, the tools will be objects-to-think-with and serve as learning artifacts for students. The most obvious finding to emerge from this study is that the classroom-learning environment should offer students choices and let them select software tools via dialogical process and collaborative culture whenever launching the course. Students can soon after involve in *Constructing the Learning Environment* suited for higher education. It may be that these students benefited from using the learning platform where students have choices and agreement in deploying the convivial tools by themselves.

7.3. Implications for further research

The findings of this study have a number of important implications for future practice.

Adopting a true learner-centered, constructionist approach and personal learning environment would imply treating each student as an individual case. In a sense, it would imply that the construction of learning environment should be designed to match the profile of individual learners and can empower them the learning to learn. The adaptability to individual needs should notice from the constructionist concept that learners make sense of the world in their own way. It is a personalized process. In fact some of LMS or MLE, like StudIP, ILIAS, uPortal and Sakai can support the concept of personalization and customization that is tailored the learning environment to a personal learning environment

Turning now to the experimental evidence on giving the authorship to student, it conveys a significant influence to foster student-centered learning. Concerning the technology, if the new media or tool is developed for the learning and thinking, but is used in the traditional way, it may be useless or even failure in delivery to user. Taken together, these results suggest that we should not pay attention only on computer tools, but also on pedagogical process and learning environment. Indeed, to support and challenge students in using technological tools in classroom, these findings enhance our understanding of the following concerns:

- Interactivity with tools and among participants
- Encouragement in using tools regularly and collaboratively
- Choices and collection of various media tools
- Differences and similarities to the traditional classroom

Eventually, a number of important limitations and further researches need to be considered in this work.

First, this research has not made a point of the pedagogy of assessment, this might be considered as the subject of a separate further work. However, the assessment in constructionist approaches might imply the quality assessment of conceptual understanding, learning performance and class participation.

Secondly, the current study has only examined with a small class size, consideration must be applied, as the findings might not be transferable to a huge class size like being in a huge lecture hall. The move towards bigger classes is causing less communication and interaction among some students. Therefore, a new model of design experiment might be undertaken.

Lastly, the study did not evaluate the use of specific learning environment. More broadly, research is also needed to determine the advantages and disadvantages of campus learning software in details, thus, considerably more work will need to be done to investigate and determine the better learning environment or LMS at university.

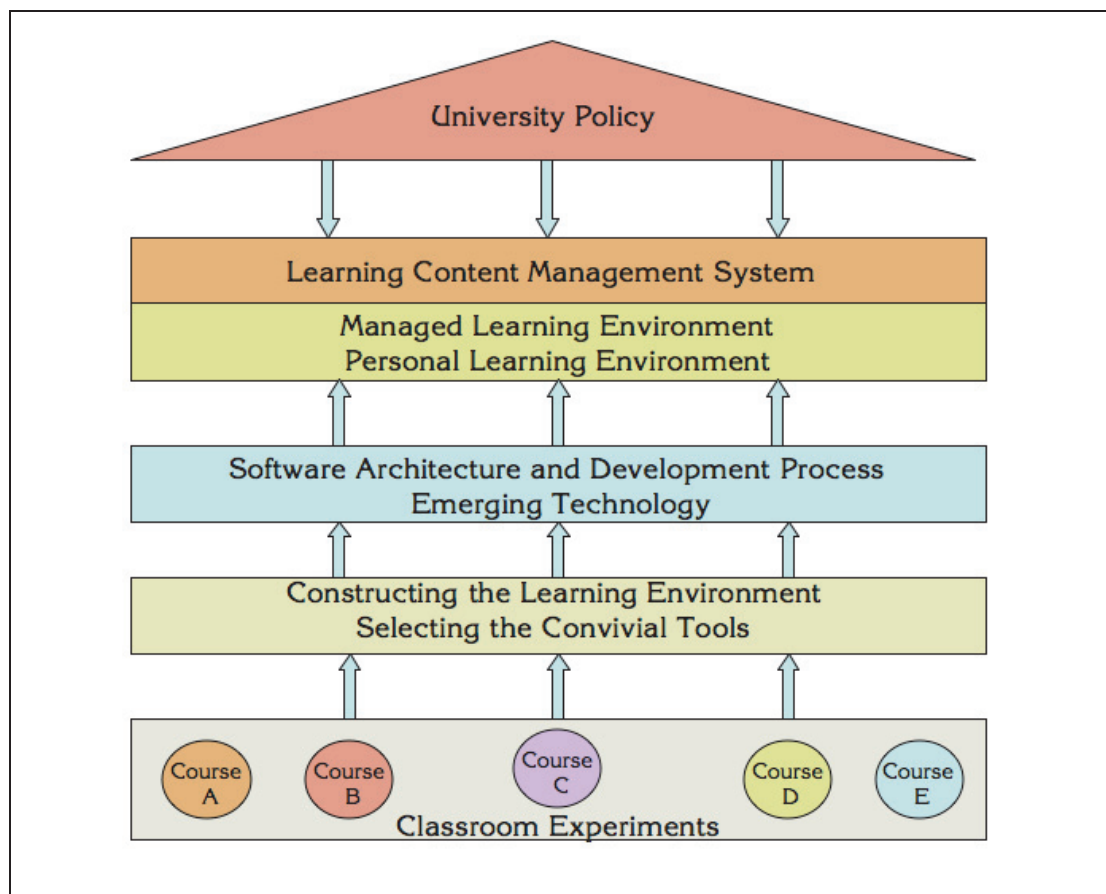
A reasonable approach to tackle this issue could be the role and influence of technology-enriched learning, in particular Web 2.0 or Learning 2.0 for higher education. The university policy should react quickly to the emerging trends of technology like social software application.

The present study confirms previous findings and contributes additional evidence that the emerging technology and social software should be profoundly monitored and studied in higher education context. In general, therefore, it seems that the heterogeneous legacy system is still available in campus and may not be left; the following issues should be considered when we integrate and develop a new emerging learning tool into the existing system.

- Interoperability
- Extensibility
- Reusability
- Platform independency

Is it, in fact, necessary to choose between the all-in-one learning platform and social software? The computer service center should understand the net-generation or new generation trend in using technology, so that the learning environment may be rethought and the university may have a new role as a facilitator. These discussions generate the new direction of the supplementary research regarding the role of university, computer service center, teachers, students and other staffs. Further research should therefore concentrate on the investigation of three separate subscales: university policy, learning platform implementation and classroom usage, respectively, as depicted in Figure 54.

Figure 54 : Subscales Component of Further Research



7.4. Outlook and future design

Experiences from the case studies showed that the constructionist process enables students to design and generate their ideas about how to improve learning environment and how to select their convivial computer tools into classroom. We situate the tools as an object-to-think-with in their learning communities. Using computers to share information is powerful medium, because students can express their ideas, present their project online, share activities with others and think about learning.

In this thesis, we, however, do not claim that constructionist learning environments and convivial tools are the only way to access the powerful ideas that students share and interact in class. It is commonly known that learning even happens without any computer support and without any collaboration. There are other alternative interaction modes; such as discussing face-to-face in classroom, writing personal diary in weblog or Facebook, sending short message text, talking via chat program, or even informal meeting in cafeteria, those communication environments can also empower powerful ideas. It is a blended learning environment that may support students to learn socially and individually.

The same learning might occur in the other types of classroom and guidance. Indeed, we shall empower the students and provide a better way of learning via the physical learning environment, if we provide them the cosy atmosphere to cultivate a reflective and collaborative learning culture.

Few work in higher education concerned about room setting and affect of the room design. Regarding case studies, the single most noticeable observation is the classroom architect. The classroom seating arrangement, classroom size, interior areas, mood and tone, colours, furniture design, and light illumination has a powerful effect on interaction in learning environment and all influence how students learn. A variety of floor plan and interior design can be done in decorating the room and organizing desks and chairs. Interestingly, this classroom architect and interior aspect, however, can be created motivation and encouraged interaction during the lecture. Last but not least, more research on these topics needs to be undertaken. The augment and association between classroom interior and convivial computer environment should more clearly understand.

REFERENCES

- [Achterman, 2006] Achterman, D. (2006). Beyond wikipedia. *Teacher Librarian*, 34(2), 19–22.
- [Ackermann, 1996] Ackermann, E. (1996). Perspective-taking and object construction: Two keys to learning. In Kafai, Y. and Resnick, M., (Eds.), *Constructionism in Practice: Designing, Thinking and Learning in a Digital World*, 25–35. Lawrence Erlbaum.
- [Ackermann, 2001] Ackermann, E. (2001). Piaget's constructivism, Papert's constructionism: What's the difference? Last visit 10 October 2008. http://learning.media.mit.edu/content/publications/EA.Piaget%20_%20Papert.pdf
- [Adelsberger et al., 2002] Adelsberger, H. H., Collis, B., and Pawlowski, J. M. (Eds.) (2002). *Handbook on Information Technologies for Education and Training*. Springer-Verlag, Berlin.
- [Amundsen and Sohbat, 2008] Amundsen, C., and Sohbat, E. (2008). The untapped learning potential of CMC in higher education. In Kelsey, S. and Amant K. St. (Eds.), *Handbook of research on computermediated communication*, 1-14. New York: Information Science Reference.
- [Anderson 2004] Anderson, T. (2004). Toward a theory of online learning. In Anderson T. and Elloumni F. (Eds.), *Theory and practice of online learning*. Athabasca, AB: Athabasca University Press. Last visit 10 October 2008. http://cde.athabascau.ca/online_book/ch2.html
- [APA, 1997] American Psychological Association (APA), 1997. *Learner-centered psychological principles: A framework for school redesign and reform*. Last visit 5 May 2008. <http://www.thebalanceconsortium.org/downloads/14%20Principles.pdf>
- [Audi, 2003] Audi, R. (2003). *Epistemology: A Contemporary Introduction*. London: Routledge.
- [Badcock et al., 1996] Badcock, K. J., Littlejohn, A., Baldwin, A., Watt, R. and Robb, M. (1996). A friendly introduction on the web to uid dynamics, *Active Learning*, (5), 26.
- [Barker, 2004] Barker, B. (2004). Adopting SCORM 1.2 Standards in a Courseware Production Environment. *International Journal on E-Learning*, 3(3), 21-24.
- [Barnett, 2000] Barnett, R. (2000). *Realizing the University: in an Age of Supercomplexity*. Bucks: Open University Press.
- [Barr and Tagg, 1995] Barr, R., and Tagg, J. (1995). From teaching to learning: A new paradigm for undergraduate education. *Change*, 27(6), 12-25.
- [Barr, 1998] Barr, H. (1998). Competent to collaborate: towards a competency based model for inter-professional education. *Journal of Interprofessional Care*, 12(2).
- [Bednar et al., 1991] Bednar, A. K., Cunningham, D., Duffy, T. M., and Perry, J. D. (1991). Theory into practice: How do we link? In Anglin G. (Ed.) *Instructional Technology: Past, present and future*. Englewood, CO: Libraries Unlimited.

[Berg et al., 2007] Berg, J., Berquam, L., and Christoph, K. (2007, March/April). Social networking technologies: A “poke” for campus services. *EDUCAUSE Review*, 42(2), 32–44.

[Bers and Urrea, 2000] Bers, M. and Urrea, C. (2000). Technological prayers: Parents and children working with robotics and values. *Robots for kids: Exploring new technologies for learning experiences* (Druin, A. and Hendler, J. (Ed)), ACADEMIC Press, pages 193-217.

[Bers et al, 2006] Bers, M., Rogers, C., Beals, L., Portsmore, M., Staszowski, K., Cejka, E., Carberry, A., Gravel, B., Anderson, J., and Barnett, M. (2006). Innovative session: early childhood robotics for learning. In *Proceedings of the 7th international Conference on Learning Sciences* (Bloomington, Indiana, June 27 - July 01, 2006). International Conference on Learning Sciences. International Society of the Learning Sciences.

[Bers, 2001] Bers, M. (2001). Identity construction environments: Developing personal and moral values through the design of a virtual city. *The Journal of The Learning Sciences*, 10(4), 365-415.

[Biggs, 1999] Biggs, J. (1999). *Teaching for quality learning at university*, Buckingham: SRHE and Open University Press.

[Bobrow and Collins, 1975] Bobrow, D. G. and Collins, A. (1975). *Representation and Understanding: Studies in Cognitive Science*, Academic Press, Inc., Orlando, FL.

[Bohm, 1996] Bohm, D. (1996). *On Dialogue*. New York: Routledge.

[Bolanle and Indi, 2010] Bolanle A. O. and Indi M. W., (2010). *Web 2.0 and Learning: A Closer Look at Transactional Control Model in E-Learning*. Texas Tech University, USA.

[Bonk and Cunningham, 1998] Bonk, C. J., and Cunningham, D. J. (1998). Searching for learner-centered, constructivist, and sociocultural components of collaborative educational learning tools. In Bonk C. J. and King K. S. (Eds.), *Electronic Collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse*, 25-50. Mahwah Erlbaum, NJ.

[Boutin, 2006] Boutin, P. (2006). Web 2.0: The new Internet boom does not live up to its name. *Slate*. Last visit 10 October 2008. <http://www.slate.com/id/2138951>

[Bowen, 2005] Bowen, S. (2005). Engaged learning: are we all on the same page? *Peer Review*, 7(2), 4-7.

[Bransford et al., 2000] Bransford, J. D., Brown, A. L., and Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school* (Expanded Edition). Washington, DC: National Academy Press.

[Britannica - The Online Encyclopedia, 2001] Britannica - The Online Encyclopedia. Last visit 10 October 2001. <http://www.britannica.com/>

[Brown and Atkin, 1988] Brown, G. and Atkins, M. (1988). *Effective Teaching in Higher Education*. London: Methuen.

[Brown and Race, 2002] Brown, S. and Race, P. (2002). *Lecturing: a Practical Guide* London: Routledge.

[Brown, 1992] Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences*, 2(2), 141-178

[Brown, 1998] Brown, D. (1998). *Education and Artificial Intelligence*. The School of Information, The University of Texas at Austin. Last visit 15 September 2005. http://www.gslis.utexas.edu/~palmquis/courses/project98/education/DEVA_B~1.HTM

[Brown, 1999] Brown, J. S. (1999). *Learning, Working and Playing in the Digital Age*. (1999). Conference on Higher Education of the American Association for Higher Education, March 1999, Washington, USA.

[Bruckman and Resnick, 1996] Bruckman, A. and Resnick, M. (1996). The MediaMOO project: Constructionism and professional community. In Kafai, Y. B. and Resnick, M., editors, *Constructionism in Practice: Designing, Thinking, and Learning in a Digital World*, 207–221. Lawrence Erlbaum Associates.

[Bruckman, 1997] Bruckman, A. (1997). *MOOSE Crossing: Construction, Community, and Learning in a Networked Virtual World for Kids*. PhD thesis, MIT Media Lab.

[Butler et al., 2000] Butler, D., Martin, F., and Gleason, W. (2000). *Empowering Minds by Taking Control: Developing Teachers' Technological Fluency with LEGO Mindstorms*.

[Carr and Kemmis, 1986] Carr, W. and Kemmis, S. (1986). *Becoming Critical: Education, Knowledge and Action Research*. London: The Falmer Press.

[Cavallo, 1996] Cavallo, D. (1996). *Leveraging Learning through Technological Fluency*. Cambridge, MA: MIT Media Laboratory Master's Thesis, Massachusetts Institute of Technology.

[Cavallo, 1999] Cavallo, D. (1999). *Project Lighthouse in Thailand: Guiding Pathways to Powerful Learning*. In *Logo Philosophy and Implementation*. Montreal, Canada: LCSl, 129-164.

[Cavallo, 2000] Cavallo, D. (2000). Emergent design and learning environments: building on indigenous knowledge, *IBM Systems Journal*, 39 (3-4), 768-781, July 2000.

[Chapman, 2006] Chapman, R. (2006). *Pearls of Wisdom: Technology for Intentional Reflection and Learning in Constructionist Cooperatives*. MIT Doctoral Thesis. MIT Department of Electrical Engineering, Cambridge, MA.

[Chen, 2001] Chen, W. F. (2001). *Learning with Hypermedia: Potential Problems and Research Suggestions*. Proceedings of the 5th Global Chinese Conference on Computers in Education (GCCCE)/ the 10th International Conference on Computer-Assisted Instruction 2001, Chungli, Taiwan.

[Chong, 1998] Chong, S. M. (1998). Models of asynchronous computer conferencing for collaborative learning in large college classes. In Bonk C. J. and King K. S. (Eds.), *Electronic collaborators*, 157-182. Mahwah, NJ: Lawrence Erlbaum.

[Clark, 2004] Clark, D. R. (2004). Kolb's Learning Styles and Experiential Learning Model. Excerpt from Kolb. Last visit 10 October 2008 <http://www.nwlink.com/~donclark/hrd/styles/kolb.html>

[Coates, 2005] Coates, T. (2005). An Addendum to a Definition of Social Software, plasticbag.org website, Last visit 10 October 2008. http://www.plasticbag.org/archives/2005/01/an_addendum_to_a_definition_of_social_software.shtml

[Cole and Engeström, 1993] Cole, M., and Engeström, Y. (1993). A cultural-historical approach to distributed cognition. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations*, 1-46. Cambridge, England: Cambridge University Press.

[Cole, 1996] Cole, M. (1996). *Cultural Psychology: A once and future discipline*. Cambridge, MA., Harvard University Press.

[Collis and van der Wende, 2002] Collis, B. and van der Wende, M. (2002). *Models of Technology and Change in Higher Education. An international comparative survey on the current and future use of ICT in education*. University of Twente, Center for Higher Education Policy. <http://www.utwente.nl/cheps/documenten/ictrapport.pdf>

[Contextual Design, 2008] University of Twente, The Netherlands. Last visit 10 October 2008. <http://www.utwente.nl/cw/theorieenoverzicht/>

[Coppola, 2004] Coppola, E. M. (2004). *Powering up: Learning to teach well with technology*. New York: Teachers College Press.

[Cottrell, 2001] Cottrell, S. (2001). *Teaching Study Skills and Supporting Learning*. Basingstoke: Palgrave Macmillan.

[Cowan, 1998] Cowan, J (1998). *On Becoming an Innovative University Teacher*. Open University Press, Buckingham.

[CSCL, 2006] CSCL- Computer Supported Collaborative Learning Community. Last visit 10 December 2006. <http://cscl-community.blogspot.com/>

[Cuban, 2001] Cuban, L. (2001). *Oversold and underused: Computers in the classroom*. Cambridge, MA: Harvard University Press.

[Davis, 1997] Davis, J. R. (1997). *Better Teaching, More Learning*. Phoenix: American Council on Education. Series on Higher Education: Oryx Press.

[Dewey, 1916] Dewey, J. (1961). *Democracy and Education*. New York: The Macmillan Company.

[Dewey, 1933, 118] Dewey, J. (1933) *How We Think*. Revised Edition. Boston: D.G. Heath.

[dLecture, 2010] d-Lecture - digitalised content, University of Bremen. Last visit 10 December 2010. <http://www.d-lecture.de/>

[Entwistle et al., 2000] Entwistle, N., Skinner, D., Entwistle, D., and Orr, S. (2000). Conceptions and beliefs about Good Teaching: an integration of contrasting research areas. *Higher Education Research and Development*, 19(1), 5-26.

[Entwistle, 1988] Entwistle, N. (1988). Motivational factors in students' approaches to learning. In *Learning strategies and learning styles*, edited by Schmeck, R. R. New York: Plenum Press, 21-49.

[Evard, 1996] Evard, M. (1996). Communities of designers: Learning through exchanging questions and answers. In Kafai, Y. B. and Resnick, M., (Eds.), *Constructionism in Practice: Designing, Thinking, and Learning in a Digital World*, 223-239. Lawrence Erlbaum Associates.

[Farren, 2005] Farren M. (2005). Creating a pedagogy of the unique through a web of betweenness BERA Conference on Practitioner Research University of Glamorgan, September 2005. Education-line, Online database.

[Fischer, 2001] Fischer, S. (2001). Course and Exercise Sequencing Using Metadata in Adaptive Hypermedia Learning Systems. *ACM Journal of Educational Resources in Computing*, 1(1), Spring 2001.

[FLE, 2004] Fle3 is a web-based learning environment. Last visit 9 September 2004. <http://fle3.uiah.fi/>

[Fowler, 2003] Fowler, M. (2003). *UML Distilled: A Brief Guide to the Standard Object Modeling Language*, Third Edition, Addison-Wesley.

[Friedman and Heafner, 2007] Friedman, A. M., and Heafner, T.L. (2007). Guest editorial: You think for me, so I don't have to. *Contemporary Issues in Technology and Teacher Education* [Online serial], 7(3). Last visit 9 December 2008. <http://www.citejournal.org/vol7/iss3/socialstudies/article1.cfm>

[Fröbel, 2008] Friedrich Wilhelm August Fröbel. The encyclopaedia of informal education. Last visit 27 September 2008. <http://www.infed.org/thinkers/et-froeb.htm>

[Fry et al., 2003] Fry, H., Ketteridge, S. and Marshall, S. (2003). Understanding student learning. In Fry, H., Ketteridge, S. and Marshall, S. (Eds.). *A Handbook for Teaching and Learning in Higher Education: Enhancing Academic Practice*, 2nd ed., London and Sterling, VA: Kogan Page, 9-25.

[Garrison, 1997] Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. In *Adult Education Quarterly*.

[Gibbs, 1992] Gibbs, G. (1992). Improving the quality of student learning through course design. In Barnett, R. (Ed.) *Learning to Effect*. Buckingham: SRHE. Open University Press.

[Gosling, 2003] Gosling, D. (2003). Supporting student learning. In Fry, H., Ketteridge, S. and Marshall, S. (Eds.). *A Handbook for Teaching and Learning in Higher Education: Enhancing Academic Practice*, 2nd ed., London and Sterling, VA: Kogan Page, 162-181.

[Greeno et al., 1996] Greeno, J. G., Collins, A. M., and Resnick, L. B. (1996). Cognition and learning. In D. C. Berliner and R. C. Calfee (Eds.), *Handbook of educational psychology*, 15–46. New York: Simon and Schuster Macmillan.

[Griffiths and Partington, 1992] Griffiths, S. and Partington, P. (1992). *Enabling Active Learning in Small Groups in Effective Learning and Teaching in Higher Education Module 5, Parts 1 and 2 (CVCP)*.

[Griffiths et al., 2002] Griffith, T. L., Tansik, D. A., and Benson, L. (2002). Negotiating successful technology implementation: An empirical investigation of World Wide Web use. *Group Decision and Negotiation*, 11, 1-22.

[Habeshaw et al., 1992] Habeshaw, S., Gibbs, G. and Habeshaw, T. (1992). *53 Interesting Things to do in Your Seminars and Tutorials*. Plymouth: TES Books.

[Hall, 2009] Hall, R. (2009). Towards a fusion of formal and informal learning environments: the impact of the read/write web. *Electronic Journal of eLearning*, 7(1), 29-40.

[Hammond and Manfra, 2009] Hammond, T. C., and Manfra, M. M. (2009). Giving, prompting, making: Aligning technology and pedagogy within TPACK for social studies instruction. *Contemporary Issues in Technology and Teacher Education*. Last visit 27 August 2010. <http://www.citejournal.org/vol9/iss2/socialstudies/article1.cfm>

[Hannafin and Land, 2000] Hannafin, M. J., and Land, S. M. (2000). Technology and student-centered learning in higher education: Issues and practices. *Journal of Computing in Higher Education*, 12 (1), 3-30.

[Hannafin et al., 1994] Hannafin, M. J., Hall, C., Land, S., and Hill, J. (1994). Learning in open-ended learning environments: Assumptions, methods, and implications. *Educational Technology*, 34 (8), 48-55.

[Harel, 1991]. Harel, I. (1991). *Children Designers: Interdisciplinary Constructions for Learning and Knowing Mathematics in a Computer-Rich School*. Norwood, NJ: Ablex Publishing.

[Harper et al, 2000] Harper, B., J. Hedburg, B. and Lockyer. 2000. Review of research. The on-line experience: The state of Australian on-line education and training practices. Adelaide, Report prepared for NCVET.

[Harris and Hofer, 2006] Harris, J., and Hofer, M. (2006, July). Planned improvisations: Technology-supported learning activity design in social studies. Session presented at the National Educational Computing Conference, San Diego, CA. Last visit 9 May 2008. http://center.uoregon.edu/ISTE/NECC2006/program/search_results_details.php?sessionid=13514149

[Hativa and Goodyear, 2002] Hativa, N., and Goodyear, P. (Ed.). (2002). *Teacher Thinking, Beliefs and Knowledge in Higher Education*. London: Kluwer Academic Publishers.

[HEFCE, 2006] The Higher Education Funding Council for England (HEFCE). Last visit 9 December 2006. <http://www.hefce.ac.uk/>

[Horgan, 2003] Horgan, J. (2003). Lecturing for Learning. In: Fry, H., Ketteridge, S. and Marshall, S. (Eds.). In *A Handbook for Teaching and Learning in Higher Education: Enhancing Academic Practice*, 2nd ed., London and Sterling, VA: Kogan Page, 75-90.

[Hung and Chen, 2001] Hung, D. W. L., and Chen, D. T. (2001). Situated Cognition, Vygotskian Thought and Learning from the Communities of Practice Perspective: Implications for the Design of Web-Based E-Learning. *Educational Media International*, 38, 1, 3-12.

[Hutchins, 1995] Hutchins, E. (1995). *Cognition in the wild*. Cambridge, MA: MIT Press.

[Illich, 1971] Illich, I. (1971). *Deschooling Society*, New York: Harper and Row. Also available from: <http://www.preservenet.com/theory/Illich/Deschooling/intro.html>

[Illich, 1973] Illich, I. (1973). *Tools for Conviviality*. New York: Harper Colophon Books. Also available from: http://clevercycles.com/tools_for_conviviality/

[IMS, 2006] The IMS Learning Design specification (IMS LD). Last visit 10 July 2006. <http://www.imsglobal.org/learningdesign/index.html>

[ISO 13407, 2006] Human-centred design processes for interactive systems. Last visit 10 July 2006. http://www.iso.org/iso/catalogue_detail.htm?csnumber=21197

[Jakes, 2006] Jakes, D. (2006, August). Wild about Wikis; Tools for taking student and teacher collaboration to the next level. *Technology and Learning*, 27(1), 6. Last visit 10 October 2008. <http://www.techlearning.com/article/6164>.

[Jamie, 2009] Jamie. (2009, May 19). Great Thinkers on Self-Education: Ivan Illich. Last visit 2 August 2009. Message posted to <http://selfmadescholar.com/b/2009/05/19/great-thinkers-on-self-education-ivan-illich/>

[JISC, 2001] Joint Information Systems Committee (JISC). The UK education and research communities. Last visit 5 December 2001. <http://www.jisc.ac.uk/>

[Johnson et al., 2006] Johnson, M., Liber, O., Wilson, S., and Milligan, C. (2006). The personal learning environment: a report on the CETIS PLE project. Last visit 10 May 2006. <http://wiki.cetis.ac.uk/image:plereport.doc>

[Johnson et al., 2007] Johnson, L., Levine, A., and Smith, R. (2007). *The 2007 Horizon Report*. Austin, Texas: The New Media Consortium. Last visit 9 September 2008. <http://www.nmc.org/horizon/2007/report>

[Johnson et al., 2008] Johnson, L., Levine, A., and Smith, R. (2008). *The 2008 Horizon Report*. Austin, Texas: The New Media Consortium. Last visit 9 September 2008. <http://wp.nmc.org/horizon2008/>

[Johnson et al., 2009] Johnson, L., Levine, A., and Smith, R. (2009). *The 2009 Horizon Report*. Austin, Texas: The New Media Consortium. Last visit 27 February 2010. <http://wp.nmc.org/horizon2009/>

[Jonassen and Carr, 2000] Jonassen, D. H. and Carr C. S. (2000). Mindtools: affording multiple knowledge representations for learning. In Lajoie, S. P. (Ed.), *Computers as cognitive tools: No more walls*, 2, 165-196. Lawrence Erlbaum Associates: Mahwah, NJ.

[Jonassen and Reeves, 1996] Jonassen, D. H., and Reeves, T. C. (1996). Learning with technology: Using computers as cognitive tools. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology*, 1st edition, 693-719. New York: Macmillan.

[Jonassen et al., 1995] Jonassen, D., Davidson, M., Collins, M., Campbell, J. and Haag, B. (1995). Constructivism and Computer-mediated Communication in Distance Education. *American Journal of Distance Education* 9(2), 7-25.

[Jonassen et al., 1999] Jonassen, D. H., Peck, K. L. and Wilson, B. G. (1999). *Learning with Technology: A Constructivist Perspective*. Upper Saddle River, NJ: Prentice Hall Inc.

[Jonassen, 2000] Jonassen, D. (2000). *Computers as Mindtools for Schools: Engaging in Critical Thinking*. Publisher Upper Saddle River, N.J. Merrill.

[Kafai and Resnick, 1996] Kafai, Y. B. and Resnick, M., (Ed.) (1996). *Constructionism in Practice: Designing, Thinking, and Learning in a Digital World*. Lawrence Erlbaum Associates.

[Kaiser Foundation, 2005] Kaiser Foundation. (2005). *Generation M: Media in the lives of 8-18 year-olds*. Released on Wednesday, March 9, 2005 in Washington, D.C. Last visit 10 October 2008. <http://www.kff.org/entmedia/entmedia030905pkg.cfm>

[Katterfeldt et al., 2009] Katterfeldt, E., Dittert, N., and Schelhowe, H. (2009). EduWear: smart textiles as ways of relating computing technology to everyday life. In *Proceedings of the 8th international Conference on interaction Design and Children* (Como, Italy, June 03 - 05, 2009). IDC '09. ACM, New York, NY, 9-17.

[Kirschner and Davis, 2003] Kirschner, P. and Davis, N. (2003). Pedagogic Benchmarks for Information and Communications Technology in Teacher Education. *Technology, Pedagogy and Education*, 12 (1), 125-144.

[Kirschner and Gerjets, 2006] Kirschner, P. A. and Gerjets, P. (2006). Instructional design for effective and enjoyable computer-supported learning. *Computers in Human Behavior*, 22(1).

[Kirschner et. al, 2006] Kirschner, P., Sweller, J. and Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational psychologist*, 41(2), 75-86.

[Kirschner, 2005] Kirschner, P. A. (2005). Learning in innovative learning environments. *Computers in Human Behavior*, 21(4).

[Kolb, 1984] Kolb, D. (1984). *Experiential Learning. Experience as the Source of Learning and Development*, New Jersey: Prentice-Hall, Englewood Cliffs.

[Kopler and Sloep, 2003] Kopler, E. J. R., and Sloep, P. (2003). Learning Networks: Connecting people, organizations, autonomous agents and learning resources to establish the emergence of effective lifelong learning. Heerlen: Open University of the Netherlands.

[Korda, 1976] Korda, M (1976). Power in the Office, Weidenfeld and Nicolson, London.

[Koschmann, 1996] Koschmann, T. (1996). Paradigm shifts and instructional technology: An introduction. In T. Koschmann (Ed.), CSCL: Theory and practice of an emerging paradigm, 1-23. Mahwah, NJ: Erlbaum.

[Kovalchick and Dawson, 2004] Kovalchick, A. and Dawson, K. (2004). Education and Technology: An Encyclopedia. Santa Babra, CA: ABC-CLIO, Inc.

[Kumar, 1996] Kumar V. S. Computer-supported collaborative learning: issues for research. http://www.cos.ufrj.br/~jano/CSCW2008/Papers/Kumar_.pdf

[L3, 2006] The Center for Lifelong Learning and Design. University of Colorado. Last visit 10 February 2006. <http://l3d.cs.colorado.edu>

[Lai, 1999] Lai, K. W. (1999). Net-Working: Teaching, Learning and Professional Development with the Internet. Dunedin, New Zealand: University of Otago Press.

[Lajoie, 2000] Lajoie, S. P. (Ed.). (2000). Computers as cognitive tools: No more walls, 2. Mahwah NJ: Lawrence Erlbaum Associates.

[Lambropoulos and Romero, 2009] Lambropoulos, N and Romero, M. (2009). Educational Social Software for Context-Aware Learning: Collaborative Methods and Human Interaction by Educational Social Software (ESS).

[Laurillard, 2002] Laurillard, D. (2002). Rethinking University Teaching. A conversational framework for the effective use of learning technologies. London: Routledge.

[Lave and Wenger, 1991] Lave, J., Wenger, E. (1991). Situated Learning: Legitimate Peripheral Participation (Learning in Doing: Social, Cognitive and Computational Perspectives) Cambridge: Cambridge University Press.

[Lave and Wenger, 1996] Lave, J. and Wenger, E. (1996). Practice, person, social world. In Daniels, H. (Ed.), An introduction to Vygotsky, 143–150. Routledge.

[Lave and Wenger, 1998] Lave, J., and Wenger, E. (1998). Situated learning: Legitimate peripheral participation (Chapter 4: Legitimate Peripheral Participation in Communities of Practice). New York: Cambridge University Press.

[LCSI, 2008] Introduction: What is Logo? And Who Needs It? Last visit 17 November 2008. <http://www.microworlds.com/support/logo-philosophy-papert.html>.

[LEGO, 2008] LEGO Mindstorms Website. Last visit 17 November 2008. <http://mindstorms.lego.com/>

[Lemke, 1993] Lemke, J. L., (1993). Education, Cyberspace, and Change, Originally published in the Electronic Journal on Virtual Culture, 1(1). Last visit 17 May 2008. <http://www.ibiblio.org/pub/academic/communications/papers/ejvc/EJVCVINI.PACKAGE>

[LITRE, 2006] Learning in a Technology-Rich Environment. Last visit 2 May 2006. <http://litre.ncsu.edu/>

[Littlejohn, 2002] Littlejohn, A. (2002). New lessons from past experiences: recommendations for improving continuing professional development in the use of ICT. *Journal of Computer Assisted Learning*, 18, 166–174.

[Luckin et al, 2009] Luckin, R. (2009). Participatory learning in context. In *Proceedings of the 9th international Conference on Computer Supported Collaborative Learning - Volume 2* (Rhodes, Greece, June 08 - 13, 2009). In Dimitracopoulou, A.m O'Malley, C. Suthers, D. and Reimann, P. (Eds.) *Computer Support for Collaborative Learning*. International Society of the Learning Sciences.

[Magolda, 1999] Magolda, B. (1999). *Creating Contexts for Learning and Self Authorship: Constructive Developmental Pedagogy*, San Francisco, Josey-Bass.

[Maia et al., 2005] Maia, L. P., Machado, F. B., and Pacheco Jr., A. C. 2005. A constructivist framework for operating systems education: a pedagogic proposal using the SOsim, ITiCSE '05 *Proceedings of the 10th annual SIGCSE conference on Innovation and technology in computer science education*, 218–222.

[Martin, 1994] Martin, F. (1994). *Circuits to Control: Learning Engineering by Designing LEGO Robots*. Cambridge, MA: MIT Media Laboratory Doctoral Dissertation, Massachusetts Institute of Technology.

[Mayes and Freitas, 2004] Mayes, T. and de Freitas, S. (2004). *JISC e-Learning Models Desk Study, Stage 2: Review of e-learning theories, frameworks and models*. UK: Joint Information Systems Committee. Last visit 13 November 2009. [http://www.jisc.ac.uk/uploaded_documents/Stage%202%20Learning%20Models%20\(Version%201\).pdf](http://www.jisc.ac.uk/uploaded_documents/Stage%202%20Learning%20Models%20(Version%201).pdf)

[Mayes, 2007] Mayes, J. T. (2007). Groundhog day again? Keynote for JISC Innovative e-Learning 2007, Institutional transformation and supporting lifelong learning, Retrieved June 11, 2007, from http://www.jisc.ac.uk/elp_conference07

[McLoughlin and Lee, 2007] McLoughlin, C. and Lee, M. J. W. (2007). Listen and learn: A systematic review of the evidence that podcasting supports learning in higher education. In Montgomerie, C. and Seale, J. (Eds), *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2007*, 1669-1677. Chesapeake, VA: AACE.

[Means and Olson, 1995] Means, B., and Olson, K. (1995, November). *Restructuring schools with technology: Challenges and strategies*. Menlo Park, CA: SRI International.

[Means et al., 1993] Means, B., Blando, J., Olson, K., Middleton, T., Morocco, C. C., Remz, A. R., and Zorfass, J. (1993). *Using technology to support education reform*. Washington, DC: U.S. Government Printing Office.

[Mejias, 2005] Mejias, U. (2005). A nomad's guide to learning and social software. *The Knowledge Tree: An E-Journal of Learning Innovation*, 7.

[Mejias, 2007] Mejias, U. (2007). Teaching social software with social software. *Innovate: Journal of Online Education*, 2(5). Last visit 13 April 2010. <http://www.innovateonline.ifo/index.php?view=article&id=260>

[Mobile Campus, 2002] mobileCampus, Universität Bremen. Last visit 13 May 2002. <http://www.mobilecampus.uni-bremen.de/>

[Moll and Greenberg, 1990] Moll, L., and Greenberg, J. (1990). Creating zones of possibilities: Combining social contexts for instruction. In Moll, L. (Ed.), *Vygotsky and education: Instructional implications and applications of socio historical psychology*, 319-348. New York: Cambridge University Press.

[Montessori, 2008] Montessori. The international Montessori indexes. Last visit 5 November 2008. <http://www.montessori.edu/>

[Moul, 2003] Moul, P. (2003). Creating a Unified Digital Campus to Satisfy the Needs of 21st century learners. *The Technology Source*. March/April 2003. Last visit 5 May 2008. http://technologysource.org/article/creating_a_unified_digital_campus_to_satisfy_the_needs_of_21st_century_learners/

[Nelson, 1998] Nelson, G. (1998). Internet/Web-based instruction and multiple. *Educational Media International*, 35(2), 90–94.

[Nielsen, 2008] Nielsen, T. W. and Fitzgerald, R. (2008). Imaginative inquiry, and imaginative practice: the imaginative education impulse. *Imaginative Inquiry, Imaginative Practice –Conference Proceedings of the 6th International Conference on Imagination and Education*, 29 – 31 January. Canberra: University of Canberra.

[Noddings, 2007] Noddings, N. (2007). *Philosophy of Education*, Boulder, CO: Westview, 2nd. Edition.

[O'Reilly, 2005] O'Reilly, T. (2005). What is Web 2.0. Design patterns and business models for the next generation of software. Last visit 5 November 2008. <http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html>

[O'Reilly, 2007] O'Reilly, T. (2007). Today's Web 3.0 Nonsense Blogstorm. *O'Reilly Radar* (4 October). Last visit 5 November 2008. http://radar.oreilly.com/archives/2007/10/web_30_semantic_web_web_20.html

[Oblinger and Oblinger, 2005] Oblinger, D. and Oblinger, J. (2005). Is it age or IT: first steps toward understanding the net generation. In D. Oblinger and J. Oblinger (Eds.), *Educating the Net Generation*, 2.1-2.20. EDUCAUSE, North Carolina State University. Accessed at <http://www.educause.edu/educatingthenetgen/> on 24 June 2005.

[Oblinger and Rush, 1997] Oblinger, D. G. and Rush, S. C. eds. (1997). *The Learning Revolution. The Challenge of Information Technology in the Academy*. Bolton, Mass: Anker Publishing Company.

[OCW, 2009] MIT OpenCourseWare (OCW). Last visit 12 January 2009. <http://ocw.mit.edu/index.htm>

[Ostwald, 1996] Ostwald, J. (1996). Knowledge Construction in Software Development: The Evolving Artifact Approach. Ph.D. Dissertation, University of Colorado at Boulder.

[Palooff and Pratt, 1999] Palooff, R. M. and Pratt, K. (1999). Building Learning: Communities in Cyberspace: Effective Strategies for the Online Classroom. San Francisco, CA: Jossey Bass Publishers.

[Papert and Harel, 1991] Papert, S. and Harel, I. (1991). Situating constructionism. In Papert, S. and Harel, I. (Eds.), Constructionism, Chapter Introduction. New York: Ablex Publishing.

[Papert and Resnick, 1995] Papert, S., and Resnick, M. (1995). Technological Fluency and the Representation of Knowledge. Proposal to the National Science Foundation, MIT Media Laboratory, Cambridge, MA.

[Papert, 1976] Papert, S. (1976). Some Poetic and Social Criteria for Education Design (AIM-373). Technical report. Last visit 10 October 2008. <http://dspace.mit.edu/handle/1721.1/6250>

[Papert, 1980] Papert, S. (1980). Mindstorms: Children, computers, and powerful ideas. Basic Books.

[Papert, 1990] Papert, S. (1990). Introduction: Constructionist Learning. Harel, I. (Ed.). Cambridge, MA: MIT Media Laboratory.

[Papert, 1991] Papert, S. (1991). Situating Construction. Constructionism. Harel, I. and Papert, S. (Eds.) Norwood, NJ: Ablex Publishing.

[Papert, 1993] Papert, S. (1993). The Children's Machine: Rethinking School in the Age of the Computer. New York: Basic Books.

[Papert, 1999a] Papert, S. (1999). Child Psychologist Jean Piaget. Time, March 29, 1999. Last visit 5 May 2003. http://www.time.com/time/classroom/psych/unit1_article1.html

[Papert, 1999b] Papert, S. (1999). What Is Logo? And Who Needs It?. Essay from Logo Philosophy and Implementation (Logo Computer Systems). Last visit 5 May 2008. <http://www.microworlds.com/support/logo-philosophy-papert.html>

[Papert, 2000] Papert, S. (2000). What's the big idea? Toward a pedagogy of idea power. IBM Systems Journal, 39(3/4), 720–729.

[Papert, 2008] Work by Seymour Papert. Last visit 5 May 2008. <http://papert.org/>

[Participatory Design, 2004] Participatory Design. Last visit 5 January 2004. <http://cpsr.org/issues/pd/>

[Pea, 1996] Pea, R. D. (1996). Seeing what we build together: Distributed multimedia learning environments for transformative communications. In Koschmann, T. (Ed.), CSCLE: Theory and practice of an emerging paradigm, 1-23. Mahwah, NJ: Erlbaum.

[Petress, 2003] Petress, K. (2003). An Educational Philosophy Guides the Pedagogical Process. *College Student Journal*, 37 (1), 128-134.

[Pettit and Mason, 2003] Pettit, J. and Mason, R. (2003). Virtual space, real learning: an introduction to VLEs. In Fry, H., Ketteridge, S. and Marshall, S. (Eds.). *A Handbook for Teaching and Learning in Higher Education: Enhancing Academic Practice*, 2nd ed., London and Sterling, VA: Kogan Page, 148-161.

[Phillips, 1985] Phillips, D. C. (1985). Philosophy of Education. In Husen, T. and Postlethwaite, N. (Eds.), *International Encyclopedia of Education*, 3859-3877.

[Phillips, 2000] Phillips, D. C. (Ed.). (2000). *Constructivism in Education: Opinions and Second Opinions on Controversial Issues*, (Series: 99th. Yearbook of the National Society for the Study of Education), Chicago: University of Chicago Press.

[Phillips, 2001] Phillips, J. A. (2001). Research in Teaching and Learning in a Technology-Based Environment: Theoretical Perspectives Influencing Inquiry Methods. *Proceedings of the Qualitative Research Convention: Navigating Challenges*, 2001, Oct. 25-26. University of Malaya.

[Phillips, 2008] Phillips, D. C. (2008). Philosophy of Education. *Stanford Encyclopedia of Philosophy*. Last visit 27 December 2009. <http://plato.stanford.edu/entries/education-philosophy/>

[Piaget, 1962] Piaget, J. (1962). *Play, Dreams and Imitation in Childhood*. New York: Norton.

[Piaget, 1972] Piaget, J. (1972). *Psychology and Epistemology: Towards a Theory of Knowledge*. Harmondsworth: Penguin.

[Piaget, 1977a] Piaget, J. (1977). The Essential Piaget (Part IX). Gruber, H. E. and Voneche, J. J., (Eds.), New York: Basic Books.

[Piaget, 1977b] Piaget, J. (1977). *The Development of thought: Equilibration of cognitive structures*. New York: Viking Press.

[Preece et al., 2002] Preece, J., Rogers, Y. and Sharp H. (2002). *Interaction design: beyond human-computer interaction*. Wiley: New York.

[Prensky, 2001] Prensky, M. (2001). Digital Natives, Digital Immigrants. In *On the Horizon*, October 2001, 9(5). Lincoln: NCB University Press, 1-6.

[Pusawiro, 2002] Pusawiro, P. (2002). Requirement analysis report for Educational Tools. ZMML Internal Report.

[Pusawiro, 2006] Pusawiro, P. (2006). Just-In-Time Learning: Re-Design of Micro Learning Platform. Toward Design Framework for a Small Group of Learners. In Hug, T. et al. (Eds). *Microlearning: Emerging Concepts, Practices and Technologies after eLearning*. *Proceedings of Microlearning 2005*. Innsbruck University Press, 173-184.

[Ravensbourne Learner Integration Project, 2006] Ravensbourne Learner Integration Project. Ravensbourne College of Design and Communication. Last visit 7 May 2006. <http://confluence.rave.ac.uk/confluence/display/SCIRCLINR/Ravensbourne+Learner+Integration+Project+Proposal>

[Read, 2006] Read, B. (2006). A week of change at Facebook, as it expands its membership. *The Chronicle of Higher Education*, 53(5), A35–A35.

[Reigeluth, 1999] Reigeluth, C. M. (1999). The elaboration theory: Guidance for scope and sequence decisions. In Reigeluth, C.M. (Ed.), *Instructional-Design Theories and Models: A New Paradigm of Instructional Theory*. (Volume II). Hillsdale, NJ: Lawrence Erlbaum Assoc.

[Reiser, 2001] Reiser, R. A. (2001). A history of instructional design and technology: Part II: A history of instructional design. *Educational Technology, Research and Development*, 49 (2), 57-67.

[Resnick, 1996a] Resnick, M. (1996). Distributed constructionism. In *ICLS '96: Proceedings of the 1996 international conference on Learning sciences*, 280–284. International Society of the Learning Sciences. Last visit 5 August 2005. <http://llk.media.mit.edu/papers/Distrib-Construct.html>

[Resnick, 1996b] Resnick, M. (1996). New Paradigms for Computing, New Paradigms for Teaching. In *Constructionism in Practice: Designing, Thinking and Learning in a Digital World*. Lawrence Erlbaum Associates.

[Resnick, 1997] Resnick, M. (1997). Programmable Bricks: Toys to Think With. *IBM Systems Journal* 35, 3, 443-452.

[Resnick, 1999] Resnick, M. (1999). Decentralized modeling and decentralized thinking. In Feurzeig, W. and Roberts, N. (Eds.), *Modeling and simulation in science and mathematics education*, 114–137. New York: Springer-Verlag.

[Resnick et al., 2000] Resnick, M., Berg, R., and Eisenberg, M. (2000). Beyond Black Boxes: Bringing Transparency and Aesthetics Back to Scientific Investigation. *Journal of the Learning Sciences*, 9(1), 7-30.

[Richardson, 2009] Richardson, W. (2009). *Blogs, Wikis, Podcasts, and Other Powerful Web Tools for Classrooms*. Corwin Press:Thousand Oaks, California.

[Rogers, 2000] Rogers, P. L. (2000). Barriers to adopting emerging technologies in education. *Journal of Educational Computing Research*, 22, 455-472.

[Roschelle, 1999] Roschelle, J. (1999). Forward. In Henderson, B., *The components on online education*. Saskatoon, Canada: University of Saskatchewan, Centre for the Study of Cooperatives, 1-4.

[Roschelle et al., 2000] Roschelle, J. M., Pea, R. D., Hoadley, C. M., Gordin, D. N. and Means, B. M. (2000). Changing how and what children learn in school with computer-based technologies. *Future of Children and Computer Technology*, 10(2) Los Altos, CA: Packard Foundation, 76–101.

[Rumbaugh et al., 2003] Rumbaugh, J., Booch G. and I. Jacobson, (2003). The Unified Modeling Language 2.0 Reference Manual, Addison-Wesley.

[Rumelhart and McClelland, 1986] Rumelhart, D. E. and McClelland, J. L. (1986). On learning the past tense of English verbs. In McClelland et al., 1986, 216-271.

[SAKAI, 2004] Sakai (2004). About Sakai. Last visit 8 September 2004. <http://www.sakaiproject.org/>

[Saltiel, 1998] Saltiel, I. M. (1998). Defining collaborative partnerships. New Directions for Adult and Continuing Education 79, 5-92.

[Saroyan and Amundsen, 2004] Saroyan, A. and Amundsen, C., (2004). Rethinking teaching in higher education: from a course design workshop to a faculty development framework, Stylus Publishing, Sterling, VA.

[Savery and Duffy, 2001] Savery, J. R., and Duffy, T. M. (2001). Problem based learning: An instructional model and its constructivist framework. CRLT Technical Report, 16(1), Indiana University: Center for Research on Learning and Technology.

[Sawyer, 2006] Sawyer, R. K. (2006). Introduction: The New Science of Learning. In Sawyer K. (Ed.), The Cambridge Handbook of the Learning Sciences, Cambridge University Press, 1-16.

[Scardamalia and Bereiter, 1994] Scardamalia, M. and Bereiter, C. (1994). The CSILE project: Trying to bring the classroom into world 3. In K. McGilly, ed., Classroom Lessons: Integrating Cognitive Theory and Classroom Practice, 201-228. Cambridge, MA: MIT Press/Bradford Books.

[Scardamalia, 2003] Scardamalia, M. (2003). Knowledge Forum (Advances beyond CSILE). Journal of Distance Education, 17 (Suppl. 3, Learning Technology Innovation in Canada), 23-28.

[Schank, 2006] Schank, R. C. Last visit 8 December 2006. <http://www.rogerschank.com/>

[Schelhowe, 2002] Schelhowe, H. (2002). Interaktion als spezifische Qualität informationstechnischer Medien. Die Virtuelle Internationale Frauenuniversität. Feministische Studien, 126-132.

[Schelhowe, 2007] Schelhowe, H. (2007). Technologie, Imagination und Lernen. Waxmann, Münster, New York, München, Berlin.

[Schneiderman, 2003] Shneiderman, B. (2003). Designing the user interface: Strategies for effective human computer interaction. Reading, MA: Addison Wesley.

[Schwartz and Bransford, 1998] Schwartz, D. L., and Bransford, J. D. (1998). A time for telling. Cognition and Instruction, 16, 475-522.

[Scradamalia and Bereiter, 1994] Scardamalia, M. and Bereiter, C. (1994). The CSILE project: Trying to bring the classroom into world 3. In K. McGilly, ed., Classroom Lessons: Integrating Cognitive Theory and Classroom Practice, 201-228. Cambridge, MA: MIT Press/Bradford Books.

[Shaw, 1994] Shaw, A. (1994). Social Constructionism and the Inner City: Designing Environments for Social Development and Urban Renewal. PhD dissertation, Massachusetts Institute of Technology.

[Shaw and Garlan, 1996] Shaw, M. and Garlan, D. (1996). Software Architecture: Perspectives on an Emerging Discipline. Prentice Hall, Englewood Cliffs, NJ.

[Shirky, 2003] Shirky, C. (2003). A group is its own worst enemy: Social structure in social software. Paper presented at the O'Reilly Emerging Technology conference, Santa Clara, CA, April 24, 2003. Last visit 8 September 2004. http://www.shirky.com/writings/group_enemy.html

[Shor and Freire, 1987] Shor, I. and Freire, P. (1987). A Pedagogy for Liberation. Dialogues on Transforming Education. Mass: Bergin and Garvey Publishers, Inc.

[Siegel, 1998] Siegel, H. (1998). Knowledge, truth and education, In Carr, D. (Ed.) Education, Knowledge and Truth: Beyond the Postmodern Impasse. London: Routledge.

[Siegel, 2008] Siegel, H. (Ed.) (2008). The Oxford Handbook of Philosophy of Education, Oxford: Oxford University Press.

[Siemens, 2004] Siemens, G. (2004). Connectivism: A Learning Theory for the Digital Age. [elearnspace.org](http://www.elearnspace.org) website. Last visit 8 May 2005. <http://www.elearnspace.org/Articles/connectivism.htm>

[Siemens, 2008a] Siemens, G. (2008). New structures and spaces of learning: The systemic impact of connective knowledge, connectivism, and networked learning. [elearnspace](http://www.elearnspace.org). Last visit 8 June 2009. http://elearnspace.org/Articles/systemic_impact.htm

[Siemens, 2008b] Siemens, G. (2008). Learning and knowing in networks: Changing roles for educators and designers. Paper 105: University of Georgia IT Forum. <http://it.coe.uga.edu/itforum/Paper105/Siemens.pdf>

[Siemens and Cormier, 2009] Siemens, G. and Cormier, D. (2009). July 2009 - Social Media: Trends and Implications for Learning. In Siemens, G. and Cormier, D. (Eds.), Proceedings of Social Media: Trends and Implications for Learning 2009. GLOBALU.

[Simões and Gouveia, 2008] Simões, L. and Gouveia, B. L. (2008). Web 2.0 and Higher Education: Pedagogical Implications. Higher Education: New Challenges and Emerging Roles for Human and Social Development. Proceedings of 4th International Barcelona Conference on Higher Education, 2. Knowledge technologies for social transformation. Technical University of Catalonia (UPC). 31 March, 1-2 April. Barcelona: GUNI. http://www2.ufp.pt/~lmbg/com/lmoes_guni08.pdf

[Sipitakiat and Cavallo, 2008] Sipitakiat, A. and Cavallo, D. P. (2008). Giving the head a hand: constructing a microworld to build relationships with ideas in balance control. In Proceedings of the 8th international Conference on international Conference For the Learning Sciences - Volume 2 (Utrecht, The Netherlands, June 24 - 28, 2008). International Conference on Learning Sciences. International Society of the Learning Sciences, 335-342.

[Sipitakiat, 2007] Sipitakiat, A. (2007). Giving the Head a Hand: Constructing a Microworld to Build Relationships with Ideas in Balance Control Media Arts and Sciences, Department of Architecture and Planning. Cambridge, MA, Massachusetts Institute of Technology.

[Sipitakiat, 2001] Sipitakiat, A., (2001) Digital Technology for Conviviality: Making the Most of Students. Energy and Imagination in Learning Environments, MIT Master's Thesis, MIT, Cambridge, MA, August, 2001.

[Slattery, 2007] Slattery, M. Convivial Tools. Last visit 8 May 2007. <http://conviviality.ouvaton.org/>

[Sleeman and Brown, 1982] Sleeman, D. and Brown, J. S., (1982). Introduction: Intelligent Tutoring Systems. In Intelligent Tutoring Systems. Orlando, Florida: Academic Press, Inc., 1-10.

[SOA, 2004] Web Services Architecture. Last visit 8 December 2004. <http://www.w3.org/TR/2002/WD-ws-arch-20021114/>

[Solomon and Schrum, 2007] Solomon, G. and Schrum, L. (2007). Web 2.0: New tools, new schools. Eugene, OR: International Society for Technology in Education.

[Somerville, 2004] Sommerville, I. (2004). Software Engineering (7th Edition) (International Computer Science Series), Addison Wesley; 7th edition.

[Sourceforge, 2004] SourceForge open source community. Last visit 8 September 2004. <http://sourceforge.net/>

[Stahl et al., 2006] Stahl, G., Koschmann, T., and Suthers, D. (2006). Computer-supported collaborative learning. In Sawyer, K. (Eds.), Cambridge handbook of the learning sciences, 409 - 426. New York: Cambridge University Press.

[StarLogo, 2008] Welcome to StarLogo! Last visit 25 October 2008. <http://education.mit.edu/starlogo/>

[Strauss and Howe, 2003] Strauss, W. and Howe, N. (2003). Millennials go to college. Great Falls, VA: Lifecourse Associates.

[Sugrue, 2000] Sugrue, B. (2000). Cognitive Approaches to Web-Based Instruction. In Lajoie, S. P. (Ed.). Computers as Cognitive Tools, Volume Two: No More Walls, 133-163. Mahwah, New Jersey: Lawrence Erlbaum Associates.

[Suthers, 1999] Suthers, D. D. (1999). Representational support for collaborative inquiry. In Proceedings of the 32nd Hawaii International Conference on the System Sciences (HICSS-32). Maui, Hawaii: Institute of Electrical and Electronics Engineers, Inc. (IEEE). Last visit 30 September 2004. <http://ilt.ics.hawaii.edu/ilt/papers/hicss99.pdf>

[Szyperski, 2002] Szyperski, C. (2002). In: Beyond Objects column Software Development, 10(1), January 2002.

[UML, 2001] The Unified Modeling Language Group. Last visit 20 October 2001. <http://www.uml.org/>

[University of Bremen, 2010] Universität Bremen, Deutschland. Last visit 8 December 2010. <http://www.uni-bremen.de/>

[University of Houston, 2010] University of Houston, College of Architecture, USA. Last visit 8 May 2010 <http://www.arch.uh.edu/programs/undergradprog/undindust/index.php>

[University of Twente, 2002] The University of Twente, The Netherlands. Last visit 8 December 2002. <http://www.utwente.nl/en>

[uPortal, 2001] uPortal (2001). uPortal Project. Last visit 25 December 2001 <http://uportal.org/>

[uPortal, 2004] uPortal (2004). uPortal in Production. Last visit 8 September 2004. <http://www.jasig.org/uportal>

[Urrea, 2004] Urrea, C. (2004). A Holistic Model for Learning Environments. Thesis Proposal submitted for the degree of doctor of philosophy in media arts and sciences.

[van Aalst, 2006] van Aalst, J., and Hill, C. M. (2006). Activity theory as a framework for analyzing knowledge building. *Learning Environments Research*, 9, 23-44.

[van Merriënboer et al., 2004] van Merriënboer, J., Bastiaens, T., and Hoogveld, A. (Eds.) (2004). Instructional Design for integrated e-learning. In *Integrated E-Learning: Implications for Pedagogy, Technology and Organisations*. Jochems, W., van Merriënboer, J., and Koper, R. (Eds.). London; RoutledgeFalmer, 13-23.

[von Glasersfeld, 1996] von Glasersfeld, E. (1996). Introduction: Aspects of Constructivism. Chapter One in Fosnot, C. T. (Ed.) *Constructivism: Theory, Perspectives, and Practice*. New York: Teachers College Press.

[Vygotsky, 1978] Vygotsky, L. (1978). *Mind and Society: The Development of Higher Psychological Processes*. Cambridge, MA.: Harvard University Press. NJ.

[W3C, 2004] Web Services Architecture. Last visit 8 September 2004. <http://www.w3.org/TR/ws-arch/>

[Waterhouse, 2005] Waterhouse, S. (2005). *The power of e-learning: The essential guide for teaching in the digital age*. Boston: Pearson.

[Wenger and Synder, 2000] Wenger, E. and Snyder, W. (2000). Communities of Practice: the organizational frontier. *Harvard Business Review*, January – Februar, 139-145.

[Wenger, 1987] Wenger, E. (1987). *Artificial Intelligence and Tutoring Systems*. Morgan Kaufmann, Los Altos, CA 94022.

[Whatis, 2001] What is website. Last visit 2 July 2001. <http://whatis.techtarget.com/>

[White et al., 2000] White, S. A., Gupta, A., Grudin, J., Chesley, H., Kimberly, G. and Sanocki, E. (2000). Evolving Use of a System for Education at a Distance. In *Proceedings of HICSS-33*. January 4-7, 2000. Island of Maui. Hawaii.

[Wilson, 2006] Wilson, G. (2006). Beyond the technocrat? The professional expert in development practice Development and Change.

[ZMML, 2004] Integrationsplattform für multimediales Lehren und Lernen. Last visit 8 May 2004. <http://www.zmml.uni-bremen.de/>

[ZMML, 2010] Zentrums für Multimedia in der Lehre. Last visit 5 December 2010. <http://www.zmml.uni-bremen.de/>

APPENDIX A: COURSES SYLLABUS DESCRIPTION

Course I:

Bremen-WiSe2001/2002: Digital Medien in Der Bildung

By Heidi Schelhowe, Werner Arnaschus and Priyakorn Pusawiro

Module: VAK 03-05-H-804.03, K 4 SWS,6 ECTS

Target:

- Bachelor Digitale Medien Modul 702-I, Angewandte Informatik
- Grundlegende Lehrveranstaltung für das Zertifikatsstudium ITG-L
- Anerkannt für EW und Lernen mit technischen Medien

Thema:

Eine praktische Erfahrung und Entwicklung mit Digitalen Medien soll in dieser Veranstaltung Ausgangspunkt sein für eine Reflexion von Lernen mit Digitalen Medien und ihrer Rolle in Bildungsprozessen mit Bezug auf entsprechende theoretische Konzepte. Die Studierenden werden im Rahmen eines Workshops mit einer Digitalen Technologie vertraut gemacht. Daraus entwickeln sie im Laufe des Semesters ein Lernprojekt, das abschließend präsentiert und – wenn möglich – praktisch mit Kindern oder Erwachsenen erprobt wird.

In der Vorlesung soll es darum gehen, Lernen und die Rolle Digitaler Medien in Lernprozessen zu reflektieren. Wie verändern sich Bildungsaufgaben in der Informationsgesellschaft? Wie ist der Umgang der Net-Generation mit Medien? Was sind die spezifischen Potenziale Digitaler Medien? Was nützen sie in Bildungszusammenhängen? Und wie müssen solche Medien gestaltet sein, eingesetzt und eingebettet werden, damit sie ihren Sinn und Nutzen entfalten können?

Themen u.a.:

- Lernen in der Wissensgesellschaft
- Potenziale Digitaler Medien
- Spielen und Lernen mit Computern in der Lebenswelt
- Bildungssoftware und Lerntheorien
- Medienkompetenz

In der Übung soll projektorientiert gearbeitet werden. Es soll in interdisziplinär zusammengesetzten Arbeitsgruppen eine praktische Arbeit entstehen, die am Ende präsentiert wird. Für einen Leistungsnachweis ist eine Ausarbeitung bis zum Ende der vorlesungsfreien Zeit (Ende März) erforderlich. Die Veranstaltung richtet sich sowohl an Studierende aus der Informatik und aus den Digitalen Medien, die sich für Bildungsthemen interessieren, wie auch an Lehramtsstudierende und Studierende anderer pädagogischer Fachrichtungen. Sie ist die Grundlegende (verpflichtende) Lehrveranstaltung im Rahmen des Zertifikatsstudiums „ITG-L“ bzw. „DiMePäd“.

Translation in English: Digital Medien in Der Bildung

Course I:

Bremen-WiSe2001/2002: Digital Media in Education

By Heidi Schelhowe, Werner Arnaschus and Priyakorn Pusawiro

Module: VAK 03-05-H-804.03, K 4 SWS,6 ECTS

Target:

- BA Digital Media module 702-I, applied computer science
- Basic course for the certificate program ITG-L
- Accredited for EW and learning with technical media

Topic:

A practical experience with digital media and development of this event should be the starting point for a reflection of learning with digital media and its role in educational processes related to corresponding theoretical concepts. Students will be made in a workshop with a digital technology familiar. From this they develop over the course of the semester, a learning project, which presents final and - if possible - tested in practice with children or adults are.

In the lecture, there will be about learning and the role of digital media in learning to reflect. How do educational tasks change in the information society? What is the use of the Net-generation media? What is the specific potential of digital media? What they use in educational contexts? And how should such media are designed to be used and embedded, enabling them to realize their purpose and value?

Topics include:

- Learning in the Knowledge Society
- Potential of digital media
- Playing and learning with computers in the everyday world
- Educational software and learning theories
- Media literacy

In the exercise is to be on a project-oriented. It will be built in interdisciplinary working groups, a practical work that will be presented at the end. For a performance record is a drawing to the end of the semester (end of March) is required. The event is aimed at students from computer science and from the digital media, interested in educational issues, as well as student teachers and students of other educational disciplines. It is the basic (mandatory) course in the Certificate Program "ITG-L" or "DiMePäd.

Open Project-Work “Digital Media and Education” in the “Center for Interaction with or through Digital Media (ZIM)”

This project is intended for all sorts of computer science students with interests in questions of education and student teachers with interests in IT. The goal is to produce small projects in interdisciplinary student groups with the view on „digital media and education“.

During the process of topic finding, topic definition and topic realisation the students will find help through coaches. We want to build an environment where students can learn the technological and pedagogical aspects and know-how.

The conditions for this course are: (1) that the students have to be open for interdisciplinary studies. (2) We expect active organisation and development of a course-suited project. (3) We also expect that every student who is applying will bring himself / herself into the work of ZIM.

The results of the projects will be presented at the beginning of the next semester and should be put on the web to be used by other students. We hope to get an increasing collection of student ideas and works for the topic „digital media and education“.

Students who are interested in an activity confirmation must have a documented work / project until the end of the semester.

All students who have applied to this course may to use the ZIM (Center for Interaction with Digital Media). You'll find a comforting atmosphere, different course offers, competent coaches and encouragement. For those who are interested in a project including children / teens we offer assistance. This includes contacts to other people in- and outside of this university, national and international.

Conditions / Terms for the acquisition of participation- and activity confirmations and ECTS-Points will be individually set.

Course 2:

Bremen-SoSe2004: Re-thinking Digital Media – Engaging Learning

By: *Priyakorn Pusawiro, Prof. Heidi Schelhowe*

Module: VAK: 03-899.52, 702-2 (ECTS: 6 -180 hours)

Zeit und Ort: Mi 10-12, MZH 7220

AV: 2 SWS

Ü: 2 SWS n. V.

Info: English

Contact eMail: pusawiro@tzi.de

Contact office: MZH 1080

**** Remark: This course is bi-weekly class. ****

This course explores the digital media, esp. the interactive media and the digital tools used for "Engaging Learning". Seeing as new technologies make possible new approaches to learning, therefore we will re-think and examine digital media in order to understand their function and how each is used to further and engage the creativity and learning processes.

One of the goals of this course is to analysis and design the digital media/technologies, as a computational tools which will be a facilitating radical change in how and what we learn nowadays in digital age. Classes will involve theoretical issues in education and computer science, object-oriented multimedia, a multimedia framework, integrated multimedia system, a design and analysis computational system, and a project-based workshop in which students will experiment with new digital media technologies.

During the course students will become both users and designers of such technological tools regarding "Digital Media". Through the semester students will participate in and reflect on a variety of learning situations, including: learning from a friend, teaching something to a friend, participating ZIM, and learning on your own. In addition, students will read, discuss materials, conduct a hands-on project, share understanding and construct their knowledge concerning "Re-thinking a digital media: Engaging Learning" via a collaborative learning environment platform, but not limit to face-to-face environment, like ZIM.

*ZIM is Zentrum für Interaktion mit Digitalen Medien <http://www.dimeb.de/zim>

Who should attend this course?

This course targets to students from Digital Media Program, Computer Science and Teacher Training School who would like to work on interdisciplinary in the field of "Digital Media", "Computational Tools" and "Learning Methodology".

Course Methodologies and Requirements

Active Participation

Students are expected to become familiar with collaborative learning via Web-Based Learning Environment as a Knowledge-Sharing-Building Platform.

<http://container.informatik.uni-bremen.de:8080/FLE>

In addition, there will be Interaction in the class, Group Work, Face-to-Face Meeting during the semester. Therefore, all participants of this course can use the ZIM (Zentrum für Interaktion mit Digitalen Medien) as a physical space for their face-to-face meeting. <http://www.dimeb.de/zim>

Readings

The participants are expected to do the readings, and to participate in discussions of the readings both in the class and via Web-Based Collaborative Learning Environment (CLE). The participant must critically read the assigned papers before attending in the class in order to contribute their thoughts and ideas to other members of the class actively.

Class presentations

Class time will be organized as discussions, not lectures. In each session the participant will be asked to summarize the readings and describe one question. If possible, the question should be post onto CLE for our learning community.

Digital documentation

The participants are expected to become familiar with Web-Based Collaborative Learning Environment (CLE) as a Knowledge Building and Sharing Platform. Through Semester, they will learn how to inquiry the knowledge via setting up a problem, explanation, searching information, evaluation the information and summary at the end.

Analysis, evaluation and re-thinking

The participants will work as a group and choose the “digital media and computational tools” which make learning is more powerful and meaningful for learners. Then they, as a group, collaborative analyze, evaluate and re-think about those tools in order to suggest a new design for “**digital media: Engaging Learning**”

Group work presentation

The participants will present their final projects to others and will incorporate the feedback into the final papers.

Final Paper

The participants will report on the results of the experience in “**Re-thinking digital media: Engaging Learning**”. The paper should introduce the selected tools and describe the analysis, evaluation and re-thinking of the “digital media and computational tools” which they choose for re-designing during the class. Moreover, they should suggest the possible framework of Digital Media, which could be used as computational tools for engaging learning.

Goals of the course

1. To explore of digital media, esp. the interactive media and the digital tools.
2. To exchange idea of "Engaging Learning", esp. Learning Process.
3. To think and examine digital, esp. new media for education.
4. To analyze and design the digital media/technologies as a computational tools for learning.
5. To share understanding and construct the knowledge concerning "Re-thinking a digital media: Engaging Learning" via a collaborative learning environment platform.

Short content of course

- o Introduction and Overview of the course
- o Engaging Learning
- o Computer Supported Collaborative Learning
- o Theoretical issues in education and computer science
- o Communities of Learners and of Practices
- o Digital media, esp. the interactive media and the digital tools
- o Object-oriented multimedia, multimedia framework and integrated multimedia system
- o Design, analysis and evaluation computational system
- o Conduct a hands-on project

Course 3:

Bremen-WiSe2005/2006: Learning in Digital Spaces

By *Heidi Schelhowe, Milena Reichel and Priyakorn Pusawiro*

Module: VAK 03-804.50/9

The main goal of the course is to give students of digital media and students of computer science a basic understanding of pedagogical contexts for the development of educational software. Design for children as well as software for adults' training and education will be addressed. The role of users in the design process and questions of general media competence and computer literacy will be considered.

Raising these questions we will look at research and academic papers in the field, and evaluate existing software. Students' task will be to present relevant publications of the field, to choose, present and discuss an interesting example of software. Finally, students are supposed to design an own piece of software, based on existing tools and software environments. Ideas how this software can be used and embedded in an educational context should be part of this work. These projects have to be conducted in small groups (3-4 students), have to be presented at the end of the semester, and a paper that describes the project and its main purposes has to be delivered til April 2006.

Topics of the course:

- Important ideas of reform pedagogy (Montessori, Dewey etc)
- Constructionism (Papert et al.)
- Learning theories and learning software
- Papers from IDC, cacm
- Education in the knowledge society
- Potentials of new media
- Learning communities
- Vifu, S-A-N as examples
- Priyakorn's research - University learning platforms and educational backgrounds

Exercises, Tools, Workshops on...

- Lego Mindstorms/Crickets
- Squeak
- Course management tool for vocational training???

APPENDIX B: COURSE 2 – PROJECT DISCUSSION FORUM

Course 2:

Bremen-SoSe2004: Re-thinking Digital Media – Engaging Learning

FLE – Future Learning Environment Platform and Project Discussion Scripts

Course Management: Course Syllabus and Outline Setting

Fle3 / Editing course context in FLE Exploration and Experience

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Fle3 / Editing course c...

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Google

Editing course context in FLE Exploration and Experience

Title of the course context: FLE Exploration and Experience

Short description: let's give any comment you found during your exploration of FLE platfrom.

Long description: please contribute your idea regarding your experience in using and exploring this Web Based Collaborative Learning Environment Platform -->FLE.
Let's share your idea along this semester and enjoy work together.

Knowledge type set: Group Exploration

Use roleplay in this context: ☐

Ravi

TON

Twister

120%

User Management: Name list of Participants in the Course

File3 / Course Management / course 03-899.52: Re-thinking digital media: Engaging Learning

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Google

Methods: Discussion Based Teaching and Learning.

Course participants:

Teachers:
pusawiro priyakorn pusawiro <pusawiro@tzi.de>
schelhowe heidi schelhowe <schelhow@informatik.uni-bremen.de>

Tutors:
fleadmin []@informatik.uni-bremen.de>
june priyakorn p. <june@media.mit.edu>

Students:
[]@informatik.uni-bremen.de>
TON []@informatik.uni-bremen.de>
Twister []@informatik.uni-bremen.de>
dlopez []@paape.de>
engle []@justice.com>
eniac []@tzi.de>
majunor []@gmxd.de>
[]@tzi.de>
Ash []@informatik.uni-bremen.de>
pius []@informatik.uni-bremen.de>
pps p. pusawiro <june@cpe.kmut.ac.th>
[]@informatik.uni-bremen.de>
_s []@tuhh.de>
[]@informatik.uni-bremen.de>
Sid []@uni-bremen.de>

Course Materials

File3 / Webtop / 03-899.52: Re-thinking digital media: Engaging Learning course folder

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Google

WebTop Knowledge Building Jamming Course Management User Management

pusawiro []

You are in: Webtop / 03-899.52: Re-thinking digital media: Engaging Learning course folder

Add folder Add document Add link Create memo

Type	Title	Size	Date
[]	roschelle J.	16.8 kB	2004-05-23
[]	16.06 Protocol	27.0 kB	2004-06-16
[]	16.06 Protocol_Final	21.6 kB	2004-06-21
[]	Database Object-Relations Model	1.8 MB	2004-06-21
[]	Protocol 30.06.04	22.7 kB	2004-07-06
[]	Protocol 05.07.04	23.5 kB	2004-07-06
[]	Protocol 30.06.04 - Updated	11.9 kB	2004-07-07
[]	Minutes Script Group 12.07.04	12.5 kB	2004-07-12
[]	Minutes of meeting 27.08.04	18.3 kB	2004-08-27

Rename Copy Cut Paste Delete Select all

Trash

Knowledge Building Forum for Project sharing idea

WebTop Knowledge Building Jamming Course Management User Management

Select course CPE200 Signals and Systems

03-899.52: Re-thinking digital media: Engaging Learning

Course information

pusawiro

Create course context

collaborative project - let's think together Hide context

8 new notes / 28 notes

this is a time to analyze and design the digital media/technologies as a computational tools for engaging learning (Full description)

(context) G.A.S.--Goal, Audience and Scope / pusawiro / 16:38 2004-06-09
(5 new notes / 23 notes)

(context) CampusOnline - current status / / 11:23 2004-07-09
(2 new notes / 3 notes)

(context) Group Work?? / / 12:09 2004-08-20
(1 new notes / 2 notes)

what is your expectation of the class? Hide context

6 new notes / 7 notes

WebTop as a repository place for upload and download sharing files

WebTop Knowledge Building Jamming Course Management User Management

Search WebTops

User information

Add folder Add document Add link Create memo

Type	Title	Size	Date
File	Assignment V - FLE Critique	14.0 kB	2004-07-10
File	FLE CRITICISM - another point...	1 kB	2004-07-26
File	Final Paper: Programmed Instruction	1 kB	2004-07-29
File	Assignment II	3.2 kB	2004-07-29
File	Assignment IV	1.0 kB	2004-07-29
File	Assignment I	1 kB	2004-07-29
File	Assignment III - Constructionism	90.0 kB	2004-07-29

Rename Copy Cut Paste Delete Trash

Courses

03-899.52: Re-thinking digital media: Engaging Learning

Notes: 44 new / 96 total

Logout

Discussion Threads: Topic – Expectation of Course

The screenshot shows a web browser window with the address bar displaying 'file:///localhost/Users/pusawiro/Desktop/Diss_CaseStudyInfo/FLE-Screen/FLE-Screen/Fle3%20-%20course%2003-899...'. The browser has a menu bar with 'Open', 'Save', 'Print', 'Find', and 'Home'. The page content is a discussion thread titled 'Response' with a sub-header 'Re-thinking!!' and a timestamp '16:53 2004-05-11'. The text of the response discusses expectations for a course on 'Media in Education' and 'Education in Media', mentioning the development of a better understanding of technologies and methodologies, and the importance of standards, qualitative, and quantitative issues.

Response 16:53 2004-05-11

Re-thinking!!

My expectaion of the course would be exploring the ideas realting to 'Media in Education' and also the other way around 'Education in Media'.

For the first part, I hope I will develop a better understanding of the technologies and methodologies in this area.

For the second part, I hope to learn about the 'standards' and 'qualitative' as well as 'quantitative' issues in this domain.

Notes from 2004-05-10:

Response 09:09 2004-05-10

expectations

Well, i hope to learn, how this new technology can be used in a positive way, where it shouldn't be used, where its advanteges and disadvantages lie, Maybe it is possible to approach this matter with a natural scepticism and criticism to work out healthy solutions, meaning, where is this technology a strong supporter for learning, or where it opens new possibilities. Is it easy to teach with it? To which already known media can it compared (but that will be most likely context sensitive)?

Discussion Treads: Topic – Software Tools

The screenshot shows a web browser window with the address bar displaying 'file:///localhost/Users/pusawiro/Desktop/Diss_CaseStudyInfo/FLE-Screen/FLE-Screen/Fle3%20-%20course%2003-899...'. The browser has a menu bar with 'Open', 'Save', 'Print', 'Find', and 'Home'. The page content is a discussion thread titled 'The Tool' with a timestamp '15:17 2004-05-05'. The text discusses the decision to use PHP for a tool, mentioning the possibility of extending FLE (an open source application server) and the need for a Unix system to use it. It also mentions Eclipse as a programming language and Umbrello UML Modeller as a tool.

The Tool 15:17 2004-05-05

So,i think we can decide to use PHP for our tool (in case of objections plz post an alternative).

We can discuss what type of tool we wanna make....i think we can start off with a simple web-site.

Someone has a better idea?

Question majunor 16:07 2004-05-05

PHP and other Tools

As far as I can see FLE is open source and based on the zope application server which is also open source. While using FLE and looking at particular shortcomings of it, one could extend FLE. Unfortunately FLE is programmed in Python, which I can't program, but wouldn't mind learning. So my idea would be, that instead of programming our own solution we could extend an already existing solution, such as (for example and not limited to) FLE.

As far as tools go, for UML I use Umbrello, which comes with KDE and is open source. Unfortunately you would need a Unix System to use it. Another alternative would be ArgoUML which is open source and written in Java. Most of it is based around Java programming so, it is perhaps not exactly what we would need.

For programming use, I would recommend Eclipse. It is primary for programming Java, but there are Plugins for many programming languages (especially C/C++) and it is open source too.

[Umbrello UML Modeller](#)

Knowledge Sharing: Topic – Programming process

The screenshot shows a web browser window with the address bar displaying a file path: `file:///localhost/Users/pusawiro/Desktop/Diss_CaseStudyInfo/FLE-Screen/FLE-Screen/Fle3%20-%20course%2003-899_...`. The browser window contains two forum posts. The first post is titled "Response" and has a sub-header "its a lot like C or Java - not like serf, smalltalk, lisp or prolog". The text of the post states: "PHP is a lot like JavaScript or C derived languages. It is very powerful. You can use it as an email client, save or read files from the client side. Its a server side scripting language. Its variables are sort of loosely typed. As I recall they use scalar variables so all variables start with a dollar sign. Other than the typing of variables though if your familiar with any c derived language (javascript, java, c++) you can pick it up quickly." The second post is also titled "Response" and has a sub-header "What about pure Java". The text of the post states: "Well, everything you can do with php you also can do with Java language. It offers a great support for distributed application (web...)with its j2EE framework. Java relies on JSP (Java Server Pages) and Servlets for the constructuion of dynamic web sites. Besides that, a huge amount of API (XML,JDBC,...) for working with whatever you might imagine are available as well."

Response
its a lot like C or Java - not like serf, smalltalk, lisp or prolog
00:30 2004-05-08

PHP is a lot like JavaScript or C derived languages.

It is very powerful. You can use it as an email client, save or read files from the client side. Its a server side scripting language. Its variables are sort of loosely typed. As I recall they use scalar variables so all variables start with a dollar sign. Other than the typing of variables though if your familiar with any c derived language (javascript, java, c++) you can pick it up quickly.

Response
What about pure Java
09:16 2004-05-09

Well, everything you can do with php you also can do with Java language. It offers a great support for distributed application (web...)with its j2EE framework.

Java relies on JSP (Java Server Pages) and Servlets for the constructuion of dynamic web sites. Besides that, a huge amount of API (XML,JDBC,...) for working with whatever you might imagine are available as well.

Knowledge Building: Topic – Learning Environment in Classroom

The screenshot shows a web browser window with the address bar displaying a file path: `file:///localhost/Users/pusawiro/Desktop/Diss_CaseStudyInfo/FLE-Screen/FLE-Screen/Fle3%20-%20course%2003-899_...`. The browser window displays a forum interface with a navigation bar at the top containing tabs: "WebTop", "Knowledge Building", "Jamming", "Course Management", and "User Management". Below the navigation bar, there is a section for "03-899.52: Re-thinking digital media: Engaging Learning" with a "Course information" link. A search bar is present with the text "pusawiro". The main content area shows a forum post titled "inject fun into learning" with a sub-header "inject fun into learning". The text of the post discusses the importance of fun in learning environments and asks questions about making FLE funnier and more engaging for end-users.

WebTop **Knowledge Building** **Jamming** **Course Management** **User Management**

Select course CPE200 Signals and Systems Change

03-899.52: Re-thinking digital media: Engaging Learning
Course information

pusawiro Search Knowledge Building

You are in: Knowledge Building : 03-899.52: Re-thinking digital media: Engaging Learning / context Re-thinking digital media: Engaging Learning / thread inject fun into learning Create link on WebTop

Problem
inject fun into learning
10:09 2004-05-09

That Fun is an important aspect of nowadays learning environments in order to engage learners is a fact that many authors defend.

It might be interesting to analyze what could be do in order to make FLE funnier to use and thus to engage more the end-users with the tool.

Why do learners are fully motivated while playing their consoles but unmotivated at classroom?

Can we take the principles that make such a media like computer games funny to play with and include them in the development of learning environment?

Actually to look at the current computer-games/video-games industry design patterns could be a good starting point.

Discussion Threads – Idea Exchange

The screenshot shows a web browser window with the address bar displaying a file path. The page content features two discussion threads, each with a title bar, a title, a timestamp, and a text area.

Thread 1:

- Title:** My Explanation
- Sub-topic:** enhancing learning environments
- Timestamp:** 10:56 2004-05-10
- Text:**

Well actually the idea was not to make FLE funnier in the sense of a game, but rather to adopt the principles that make games such an engaging experience.

It is about how to increase the learners' motivation and flow while learning (in the broader term, visiting online course, collaborating with a community, doing assignment, whatever we understand by learning).

For sure usability is a key point in order to enhance a learning environment and it will help to increase motivation, but there are another factors we can take under consideration. e.g.: customized feedbacks, track learner evolutions and activity, set learning goals properly, match learners abilities...

Thread 2:

- Title:** My Explanation
- Sub-topic:** rated posts
- Timestamp:** 06:55 2004-06-23
- Text:**

You could make threads rated: you get and give points based on the quality of the post. This is used in other threaded discussion lists.

Discussion Threads – Forum Response

The screenshot shows a web browser window with the address bar displaying a file path. The page content features a 'Question' thread and its corresponding 'Response'.

Question Thread:

- Title:** Question
- Sub-topic:** Software
- Timestamp:** 20:41 2004-06-08
- Text:**

For an overview of some e-learning software, which are to a more or lesser degree open source.
<http://freshmeat.net/search/?q=learning&ion=projects&Go.x=0&Go.y=0>

[software](#)

Response Thread:

- Title:** Response
- Sub-topic:** software
- Timestamp:** 00:44 2004-06-09
- Text:**


I find very attractive the idea of face the Learning objects thing.

Let me explain. What nowadays is going on is that learning institutions are trying to standarize the learning units/contents/ whatever into pieces they call learning objects.

Those LO follow some standards dictated by some big organization like W3C or IEEE, AIM, Following those standards (normally what they do is describe the metadata associated to the LO in some form of XML language) LMS (Learning Management system) are able to interoperate and different institutions using different LMS can exchange LO without problems (that's the goal)

This might some sort of small project /research on that topic

Jamming Session: Collaborative working on a Design Specification for Prototypes

 **Design Challenge**

Project work.Student's Life Portal. Proposal

23:13 2004-06-09

Here we go...

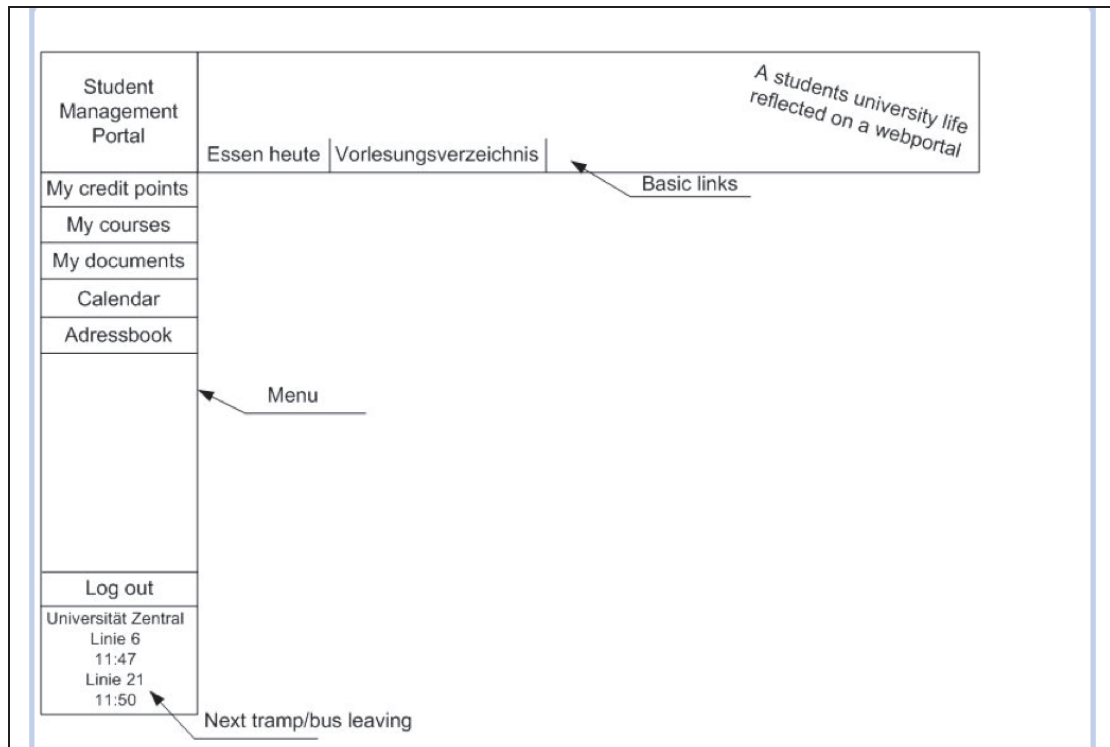
A briefly description of the idea.

Contract a simple web portal to enable students to keep track(subjects, credit points, lectures, uni. life,..) of what the did, what they are doing and what they have do regarding the studies they are involved into.

A Very first draft brainstorming for gathering the initial requiriments.

- C.P (ETCS)
- One access for all
- Courses
- Calender (with groupware function)
- Assignments
- Adressbook
- VAK -name- semester CP (auto include into calender)
- Oral examination
- Collected credits/missing credits (ects student status)
- Rules for fulfilling graduation
- Teacher can see participants
- Document Upload
- Timeline

Jamming Session: Collaborative working on a Design Sketch for Prototypes



Sample of Protocol and Minutes of the Collaborative Project

Protocol 30.06.04

Participants :

Topics discussed

- Database is setup and running along with the server.
- The server is accessible via SSH and MySql session
- Eric proposed to some HTML pages with links to some already existing tutorials and also add a learning block. This way we can integrate his idea of learning with the portal.
- Insert few links with the portal that would interest the students. For e.g. link to Bremen services.
- All groups please upload the CVS repository with the basic structure of their works so that the documentation group can start their work based in these structures.
- Documentation group should start working on the goal, scope and idea of the project.
- All of us should start developing the Use Cases for the project.

Groups

- Server:
- Look&Feel(Design):
- Databases:
- UML:
- Scripts:
- Documentation:

Fulfillments/tasks till Monday

- would finish the basic HTML layout pages so that the scripting group can start their work.
- to give something on learning by Monday
- Database group setup tables
- will complete authentication
- would generate the road map image of our status till now using MS-Project.

Next Meeting:

Monday the 5th of July 5, 2004 in ZIM GW2A 4100 at 1400hrs.

APPENDIX C: COURSE 3 – DISCUSSION SCRIPT

Course 3:

Bremen-WiSe2005/2006: Learning in Digital Spaces

Stu.IP: Discussion Forum

Stu.IP Uni Bremen

https://elearning.uni-bremen.de/forum_export.php

[to HTML view](#)

Forum: Learning in digital spaces

Allgemeine Diskussion zur Veranstaltung

from LVP-SYNC / 0 / 20.06.2005 - 00:00

Hier ist Raum für allgemeine Diskussionen

Evoking Dialogues on Tools

from Priyakorn Pusawiro / 15 / 08.01.2006 - 16:14

regarding the discussion on 08.11.2005, please share your experience and reflect your thinking about using "tools" via this Stu.IP platform. you might also freely use other tools from Stu.IP, like literature, post message, or even Wiki and so on.

please keep discussing and use Stu.IP as your playground of thinking. importantly, if you feel uncomfortable with any tool in Stu.IP, then please give a comment. if you were a designer of a new learning platform, what tools should be selected.

let think profoundly about your learning style, learning attitude and learning path via any "digital spaces".

- what do make you learn in a better?
- under what conditions do you learn best?

so, what do the tools can enhance you to learn better?

Re: Evoking Dialogues on Tools from Paisid Chiemchanya on 13.11.2005 - 15:52

We discussed about the topic, the consequences are concluded as following.

[redacted]:

I think, the learning platform should provide personal calendar feature, combining all study and personal schedule together. The feature can make easier in time management if users can consolidate personal and study life in the same time. Users can add personal appointment and schedule into the platform. The system would be perfected if the platform's database can be synchronized with other particular program such as Microsoft Outlook.

[redacted]:

I think file manager is necessary for the learning platform. File manager is the one tool that makes more convenience for users. File manager includes files uploading/downloading tools. The lecturer can upload lecture notes for the class and let students to download it and learn by themselves before the class. Students can submit their homework by uploading the homework files to the system. They have no need to meet the lecturer and send the papers of homework.

[redacted]:

I think if the learning platform has the group discuss function, it will be easier to make discussion in a small group of students in class. Now there is a lot of small group discussion in a class and I think learning platform can help us meet and discuss easily. It will collect all student contacts in class and student can select which one is in the group to make an on-line discussion together. It can also chat, transfer file or even make appointment in their schedule/calendar.

Learning platform at IUPUI / Stu.IP critics from [redacted] on 14.11.2005 - 14:06

During my semester abroad that I did for the Digital Media program in 2003 (I went to our partner university IUPUI in Indianapolis) I had the first "contact" with a learning platform used in a university context. They call it OnCourse and its basically used for all the classes running. The functionality can be compared with the one Stu.IP has, well it is designed a little simpler and may miss some features. But - I was amazed how well it supported the organizing of courses and the work for me as a student.

Every class I was attending appeared at the startung page. Selecteing them brought up a syllabus page (detailed description of the class, outline of dates / appointments plus "schein" conditions), a place for task papers, the student list, and an email like communication function for writing messages to all, the presenter or selected class mates only. It was even possible to view gradings for my own work for single projects. Compared to what I've known from Bremen, I found that a big step forward. Usually it was handed to the initiative of the tutor wether a web place for downloading slides of the seminar exists or not, and every tutor announced different URLs for finding them.

As soon as a figured out how to do it (best) I can upload some screenshots of the system here.

Since then a lot has changed, Uni Bremen introduced Stu.IP (after testing the horrible First Class thing, a windows software you had to install on your local system and that required you to click through at least 10 single window frames until you reached a place / information you intended to go to) and the IUPUI has updated OnCourse for higher integration and more functionality (in 2005).

The critical points I have for Stud.IP partly base on my experience with OnCourse. Somehow it seems that the developers wanted to create a multi-purpose, all-in-one tool that includes nearly everything possible. This functionality overkill sometimes reduces the ergonomics of the nice tools (it may sometimes be hard to keep the overview), the lists of uploaded files is difficult to handle (too many too small icons to click in order to unfold directory trees etc.). You may argue about the overall design, I think it is a little to dark, some screens and icons are too messed up. Maybe they should let a digital media guy have a look at it :)

Generally, I think such a platform is designed to support learning in classes (files, discussions, information sharing) but does not serve as a "magic learning something" by itself.

Re: Evoking Dialogues on Tools from [redacted] on 14.11.2005 - 17:36

[redacted]

I think that this tool is very good for sharing information about the studies. Its good because you can find information about available courses and etc. But I'm missing video or audio information. Also it would be good if in this system there would be availability to attend classes through the distance. I mean distance learning. Its good then you are ill and can't attend classes.

[redacted]

Impressions about Stud.IP:

The good

I found Stud.IP to be centralised and pretty convinient way to get the information concerning studies and subjects, that you take part in. It also enables you to communicate in groups or with people who take a certain subject or study in a certain field. Well, generally it does everything, you could expect it to do and even more (why on earth do you need chat there???) The best things i see about it is callender and timetable. Takes away a whole lot of headache of remembering what you have to do for the next class. Also the Address Book has a potential (the issues about it will be described later on).

The bad

The concept for me is really not one of the best ones. I have worked with similar-purposed solutions based on IBM's Lotus Notes and the other was based on the pure and simple Microsoft exchange server+Outlook+simple web page. Both of them were way ahead of StudIP in terms of simplicity and usability. If you want some info on my experience with those two, contact me in personal. Here i will concentrate on StudIP. To use StudIP you have to go to the website, login, then you access the system. In there, you have 10000 places where you can have the information. Forum, messages, mail inbox (for zfh mail you have to login AGAIN). Besides, I used to get my private messages not only to my studIP but also to the email. It took some time to figure out how to disable it, because that option is in German. And what's the system of sorting the private messages that you get? You can create a folder and move your messages there as you like them. But at least I could not find a way to set up some rules for automatic message sorting. Address book idea is great. Search and add a user. But wait, what about searching. If i enter the name Tomas Burokas, there are no matches, if I enter Burokas Tomas - I get the result! Search engine definitely needs updating!

The Ugly

Who is using studIP? "Learning in digital spaces" is the only one from all my subjects, that is currently using StudIP. Is it in some beta stage or something? Just for testing? The only possibility that i see for studip to survive is to shift all subject information and everything associated with studies on that system. Otherwise the possibilities of it do not make sence.<admin_msg autor="Tomas Burokas" chdate="1133191653">

Re: Evoking Dialogues on Tools from [redacted] on 28.11.2005 - 19:20

Your Mainly I agree with [redacted]....

When I heard about Stud.IP for the first time I thought it is useful... you can get the information about all courses from one site... I registered in

Stud.IP... and those are my impressions...

Good points:

1. File sharing... with possibility to upload your own documents... not only to download...
2. Mensa menu... the food was always one of the first needs of people...
3. Weather announcements... very practical... don't have to search for other portal with usch information.
4. Calendar and Time table... I like the option of making periodic appointments/events... you don't have to add the same event every week (what is

kind of annoying... and irritating...)

Bad points:

1. I didn't find all the courses I am attending
2. Stud.IP is deserted place... like city of ghosts... only course "Learning in Digital Spaces" is using it... So actually instead of having the information of all courses in one place... I have one more link about my courses... and to this course I have to login... when to visit sites of other course I can freely...
3. Announcements of birthdays... why do I need to know birthdays of all Bremen University students... I even don't know all of them... They could

better announce to the user the birthdays of the people, who are in his Address book.

4. Bilingual... I mean it is ok that there is possibility to get information in English and German languages... but it shouldn't be at the same time...

and now... some options are in German... some in English...

5. Unuseful chat rooms... why to need them... there are so many chatting applications and more effective in use than web chat rooms... and

Stud.IP has too many chat rooms... every user has his own chat room... and every course has chat room...

Those are all my impressions about Stud.IP... I haven't explored it closely... so I gave you my first impressions... when I find something more I will

announce it.

Re: Evoking Dialogues on Tools from [] on 14.11.2005 - 20:19

Hi!

So first of all I have to say that I think it is a very good development to manage a study through such a community. Especially in this field of study the organizers should advance such a system. I don't know and I also don't understand why the people from computer science don't use this platform. So my general opinion about this system is positive but there are some things I have to criticize.

Although I like the idea of this system I really don't like the realization. I am User and also Admin of some communities and so I have some experiences especially in things like **clarity and simplicity** of such systems. In my opinion this system should be revised completely to enhance especially these two things. In my opinion such a system should be much more simple and **easier to work with** for people who are new to such a system.

Another thing I have to criticize is this board software. **It's not only outdated but also uncomfortable to use it.** And it is everything but clearly arranged.

So I think I made clear that I do like the idea of such a system but I'm absolutely not a fan of this realization. Maybe there is a way to explain it in more details another time so I can put it into the general discussion board.

Ah one thing I forgot. I think **such a system is also good to get to know other students and maybe also to find new people for working groups.** Especially when there are people from different country it is often easier to make first conversations over the internet than talking directly to the person.

So that's it for now... maybe more in a few days or in the later discussion (which will hopefully will take place here)

[]

PS: Who finds misspellings can keep 'em ;)

Re: Evoking Dialogues on Tools from [] on 14.11.2005 - 20:59

Since we talked a lot about "tools" in the last session, I would like to start with some general thoughts about that.

I think that **a tool is always connected with a particular task (it is needed for) and a user (who uses it).**

For example, if you want to chop wood, an axe is a good tool. If you want to build a cupboard, you won't only need wood, but also a number of tools: hammer, saw, screwdriver and so on.

A tool is absolutely useless unless there is somebody actually using it. On the other hand, there might be **use scenarios for tools** which are somewhat different from what they were invented for: you can kill somebody with an axe, use a hammer to break padlocks or stir your coffee with a screwdriver, e.g.

If you don't have a specific use for a tool, it's no longer a tool but becomes something like a toy.

Another important thing is that the **best tools are really really easy to use.** You shouldn't need a manual to use a tool which supports you doing some simple task.

So when I consider Stud.IP as a tool, the users would be us as **students**, the task would be something like **"organizing your studies"** and the question would be if Stud.IP does it's job well in respect to what the users' needs are.

In general, I don't think that you need a learn platform by any means just because it is "digital" or "state of the art" or something. I can do most of my stuff pretty well with meeting people, sending around mails or chatting with ICQ, e.g.

When it comes to groupwork, I think that it is very important that you **actually meet and work together** (which doesn't mean that you have to sit in the same room, but only communicating **using e-mail/chat** can be quite exhausting).

But I also think that there are some functions a system like Stud.IP offers, which really can make a student's life easier (**download files like slides or check the latest notes like changes in venue or time etc.**).

I think the dilemma all these systems are in is that they **HAVE TO** offer such a broad selection of functions (**hardly anybody needs**) just not to look "bad" when compared with others.

Lastly, I think that **enjoyable and successful (group) work** depends a lot more on the people, their motivation and skills, and not so much on

technologies used during the work process (some years ago, people also developed great things and had a good time, though there were no personal profile pages, group chat functions or content rating mechanisms :-)).<admin_msg autor=[redacted] chdate="1131998974">

Re: Evoking Dialogues on Tools from [redacted] on 14.11.2005 - 23:58

[redacted]'s opinion

Stud.IP is a very useful tool for learning processes. Most of the tools Stud.IP uses **save thoughts of people who learn on the same topic**. So everyone who is interested can be **influenced by former ideas**. The main advantage of such a platform is **communication**. There are lot of tools which support communication like the **chat, forum or wiki**. Learning without communication is quite boring so that the motivation won't stay long on a high level.

Also the possibility of **sharing documents** is helpful. If I have lot of written stuff on the topic I am working on I don't loose much time on searching information. That leads to a higher motivation and makes it much easier to reach the learning goal.

Several tools are underestimated e.g. the chat. Last tutorium the students criticised the empty chatroom. In such a small course there is the phenomenon of missing each other. That problem can only be solved by patience while staying in the chat. It also can be used as a virtual meeting if all group members are at home. It's much easier to talk in a chatroom than writing lots and lots of emails.

[redacted]'s opinion

I think, the Stud.IP tool may be pretty helpful for a learning community. You can **share files and ideas, discuss together, ask something**. But you do not need to be in the same room, at the same time which is a big advantage. This way, people with completely different attitudes may still work together.

For me, **successful learning is e.g. that I understand difficult stuff**. Therefore, the tool may help, since I can ask other students for their opinion or about things I just did not understand. Joyful learning for me is to **work with nice people and have fun** at the same time. Stud.IP allows making appointments with other students, so it may assist joyful learning as well. Otherwise I don't know how it could make learning really joyful.

I think, it could be helpful if it was possible to talk to other students by using Stud.IP as well **(voice over IP)**. Sometimes it is difficult to explain things by writing and sometimes it takes pretty much time to write everything down.

The idea of such a learning platform seems pretty good to me, since (at least for me) it is always **easier to learn together and to know, where to get help from**. You can reach your fellow students easily.

I think, the problem about Stud.IP is, that it is not used that well. This is why e.g. the chatroom does not make much sense by now.

[redacted]'s opinion

I think, the learning platform should have a **forward message** to every email in the course that **sends an announcement** when the lecturers notice something or upload the document. From my experience I'm an exchange student from Thailand I used to use learning platform just download the document and upload homework and many time I forgot to read an announcement that made me miss the class because they changed room. So I think it's more comfortable if **we just check at the email** and it's easier than check every course that we took in the Stud.IP platform.

[redacted]'s opinion

Actually this Stud.IP is not so bad all function is quite effective and suitable for student in the course. But there are **some functions that will not be used so I think we should remove** it, such as **Chat room** that we already discussed in the class because it will always empty no one going to chat in the chat room in the same time. And I think the **Stud.IP's interface is quite complicate** so think the interface should be change to something that more easy to understand. It would be much easy to use and I think that more students would be happy to use this learn space. I'm really agree with Sarawut's opinion about to **email to every students in the course when there is an update on the learning space**. It's the good idea.

Re: Evoking Dialogues on Tools from [redacted] on 15.11.2005 - 02:15

Good idea to have a place where you can easily find information, news etc. for all your courses instead of having to bookmark every course's homepage. It also helps with **communication** sine it make it very easy to contact people form a course (for example when you are looking for a group) even when you don't know anybody.

But even though I like the idea I find stud.ip isn't that a good realisation of the idea.

First of all I find the **Structure confusing**. There's too much of everything. Options keep popping up where I don't expect them. **Instead of having one clear navigation there seem to be a lot of ways to get everywhere**. There's a lot of useless stuff that clutters up the page: like votes, a guest book, an admin page even though I'm not admin of anything, an info button that doesn't really do anything useful, birthdays of people I don't even know etc. The pages for every course (with a page for **literature, files, etc.**) **however look well done to me**.

Something that I would include in a learning platform is a forum. I find **a forum very useful** because it allows people to communicate when they are not online at the same time. It also helps **communication** because it make it easy to contact people even if you don't know anybody in that course. **A profile also seems to be a good idea**. It helps telling the people apart when there are a lot of new people. It would be nice to have avatars in the forum, too for the same reason.

However if find the forum of stud.ip very unpractical. When I click on the forum button I get to the main forum although it is unlikely that this one is interesting for me. I would find it more useful if there was a page displaying all the forums to the courses I signed up for. Also like everything else it looks very cluttered. I think I would have found a forum like for example those based on phpBB a lot more comfortable to use and more aesthetically pleasing while adding really useful functions.

I think it doesn't hurt to have a chat since they might be useful in some situations but here they seem to be empty most of the time anyway. But again there's too much clicking around when I simply want to enter a chat room.

Something I'm not sure about are the mail and the address book. I don't want another mailbox I have to check and an address book to keep. There's already the Horde webmail from the University and I only use it to forward my mails. All mails seem to be forwarded from stud.ip anyway so what's the point?

There are a lot of tools that I'm not really sure I'll use. I wish the configuration of the page would work better so I could just switch off things I don't need.

I think a learning platform can make the life of the students easier and help not to waste time on searching for the information, files etc. you need. It would be great if stud.IP could do that without annoying me that much.

However not matter how good a learning platform is I don't think it will help me that much to learn better. It can make my life easier but like Ricardo Bullan said, it's not "magic learning something" by itself.

Re: Evoking Dialogues on Tools from [redacted] on 25.11.2005 - 21:56

In my opinion Stud.IP is a great tool for course administration. I can get an overview of my courses along with actual announcements and learning materials. But in my case LIDS is the only course which takes advantage of that. Therefore I don't have much experience in using Stud.IP, but I do have a little experience using Ilias (also an eLearning platform). Ilias offers also functions for course administration. One of them is a 'personal desktop' which can be compared to the 'personal start page' in Stud.IP. It allows the user to decide exactly which items (i.e. some subscribed courses and some slides from other courses) should appear on it. In Stud.IP I can't really modify my personal start page, I can only choose a different area (i.e. 'My courses' or 'My time table') which will automatically be displayed after the login. This is the only negative thing I've noticed, I think I need to use Stud.IP more often :).

Re: Evoking Dialogues on Tools from [redacted] on 27.11.2005 - 16:58

Hi all!

First, I'd like to announce that a system like studIP is the first step in the right direction, but obviously it needs more developement. Think about our society, almost everything runs supported or even completely managed by computer technologies - as far as our university is concerned, in most cases we (the students) are forced to use old-fashioned paper-signup for courses and such. Personally, I do not know whether this is kept for traditional reasons or just because of lazyness, in fact I think what studIP offers is not sufficient.

As a modern university I'd like to see an "all-in-one" system offering the possibility to sign up for courses, to distribute information from the profs to the students, to share information on forums, and so on - not just for a single program of study but for all of them.

Each program of study / course should be listed here, should offer their documentations and assignments, but also supply students with a platform everyone can use to discuss issues, problems and solutions. After all, I like the idea of the group working system used in Informatics, nevertheless I sometimes feel like being forced to battle out against my colleagues instead of cooperating with all of them, share my knowledge, and in fact be educated as a group of new experts in computer science rather than being a single individual who succeeded in outsourcing its colleagues.

If you get my philosophical idea, you get the picture about what I think this system is required to offer the community of students.

Sorry for being that philosophical, one of my profs taught me that one cannot understand a current situation without looking into history - concerning studIP, I think one cannot talk about features before talking about purpose. :)

Geez,

-aeon<admin_msg autor="[redacted]" chdate="1133107891">

Re: Evoking Dialogues on Tools from [redacted] on 28.11.2005 - 12:40

Greetings^^

First of all I can only agree with some of the earlier posts that it is a very good Idea to use such a tool/system like Stud.IP at a university to sign up for courses and such. And also I don't really understand why we from Informatik (Diplom) don't use such a tool to sign up for courses or distributing Studying materials. I think that its a very good Idea to use such a tool, but I don't think that Stud.IP is the Ideal Solution. The User Interface is pretty complicated and you have take yourself a few minutes to understand how its structured...

just my 2 cents^^

[redacted]

Re: Evoking Dialogues on Tools from [redacted] on 28.11.2005 - 15:12

After having had some trouble to figure out which button I have to press in order to make a posting in this forum, here is what I think about Stud.IP.

First of all, I think StudIP provides is a good opportunity for teachers and students from departments where people are not trained in HTML to have a web space for their course material and communication.

But, StudIP has a significant weakness: The navigation is very confusing, I have gotten lost there already several times. And as long as people have trouble using it, they will refuse StudIP. From my point of view I would also prefer a nicer design, since Studlo looks very dull and unfriendly.

Another point is, that a successful usage of all its functions like the chat etc. can only be provided if users are permanently or at least very often online. But still not everyone has a "flatrate" at home.

One last thing I appreciate about StudIP is that students are able to upload their material. This has not been possible in the webspaces that some teachers used before StudIP came up.

Re: Evoking Dialogues on Tools from [] on 05.12.2005 - 19:52

Moin!

Firstable, I just want to post the definition of tool from the dictionary (at least it works for me when I'm trying to have make my mind about concepts)

Tool: • a device or or implement, esp. one held in the hand, used to carry out a particular function.
• a thing used in a occupation or pursuit.
• computing, a piece of software that carries out a particular function, typically creating or modifying another program.

The importance of tools is mainly around the utility of them and what you can reach with it. There are in Stud IP many different possibilities, and by possibilities I mean tools. It's always important to count with different ways to express and communicate, especially when it comes around student relations, opinions, and debating. Stud IP could be a wonderful communication "interface" between professors and students. Sadly, it's not happening.

I think it's necessary to improve the tools people are using (posting comments, schedules, studyplans) and let go the ones people are not using (chat, wiki). The aesthetics aspects are good to take in consideration.

It would be much more useful too, using just one common website to manage the courses you are taking in the University, instead of having many pages, that at the end, no one use, including the very professors.

[]

Re: Evoking Dialogues on Tools from [] on 03.01.2006 - 16:32

In my bachelors-program I encountered several learning-platforms and collaboration-tools for universities. These included a Wiki (TWiki), Ilias, OpenUSS!, Yahoo-Group and Blogs.

These system were intended (by the lecturers) to be used for collaboration among the students and better information exchange. But as there were too many systems (two is already one too much!), nobody liked to use them. The students complained about the too complicated user-interfaces and the structure. Every semester some of them tried to redesign the TWiki-System (the only system that was used by more than one professor from my courses) and delivered a new conception. One of these conceptions ended up in a new TWiki-sytem and in more confusion. This was because there were the old and the new system running at the same time.

Additionally to the existing systems one student started a blog as a solution to the confusion. This is now mainly used by the students of that program.

Platforms or mailing-lists started by students, and only considering students, have the main advantage that they can exchange their thoughts with no university-official reading them. So these will be more open and more used. Of course this is not usable for a learning platform.

The problem with the learning/collaboration-tools, like Stud.IP, is that they have very high aims that mainly reflect the aims of the system-designers. Of course students would like to have a tool that makes their learning easier and more effective, but in my opinion this can't be done by introducing new and complicated systems.

Generally said the Stud.IP-platform has too much functions included from the start, so that the first-time-user will be confused by that. Maybe a good solution would be to offer only the basic core-functions from the start. Each user can then, step by step, upgrade his personal Stud.IP by activating the desired modules manually.

There has to be a reason for logging-in several times a week. Those platforms will only work if there is a vivid community, contributing new content very frequently, so it is worth visiting it every few days. Usually community members will have to be "animated" by some leader-members who start discussions and who play a very active role in there. That is missing in Stud.IP and will be very hard to put into practice.

All courses in each university have to use the same system. At the moment I have to check several systems (Stud.IP, Aulis, DM-Wiki, E-Mails) for getting the information on my courses - and this is too much! An effect of this is that I will disregard some of them.

The function I would consider as very useful is the timetable. The problem is once more the realization. I have one course which is scheduled at the wrong time and which I can't delete or just change. That's ruining the whole function for me...

The forum, I am just writing in, is not really used as a forum. There are no real discussions taking place. Most of the students just post long statements (like this one...), because the tasks are to big. There are so many aspects which have to be considered and because the statements in the forum will be judged and given credits for, everyone wants to give a good and comprehensive contribution.

These contributions should be channeled into several small threads, only covering small parts of the general topic. Then everyone could get an overview on the whole thing and discuss in an effective way with usable results. For this reason there has to be an admin who manages the forum/threads and who also keeps the discussions alive.

Many mentioned the chat and most of them stated it is not very useful. I can only join them. This is because I think you should use the existing communication channels among the students instead of trying to create new ones. I have already many of my fellow students in my e-mail, ICQ and mobile phone contact-lists. If I have talk to them I can do it several times of the week in the "real-world", because we attend the same courses. This is in many cases more effective than an online chat.

If you are at the university and have your laptop with you, the mensa-tool is quite usefull. Too bad I have none :-)

Furthermore I like the "distance learning"-idea of Tomas. This would mean that you could easily get the contents you missed or which you just want to go through again. At my old university this has been a topic, but most lecturers refused to offer this opportunity, because they thought that no student would attend their lectures anymore. And in my opinion they are right. But for me as a student not having to attend every lecture in the morning would mean a bigger freedom and the opportunity to manage my own time for instance to work and earn money. So this remains

a wish of students.

By the way this would be the case, where a learning platform would be useful: If you do not have to attend the courses. In the situation of our masters-program, I think it is sufficient only to **exchange files** with the Stud.IP, as it is done now. In fact I could have **written this text into a PDF and uploaded** it and nothing would be different. Maybe it would be **easier to read and to print** out than in this forum. **I see this tool only as an exchange-platform for files**, because I don't use the other tools.<admin_msg autor="[redacted]" chdate="1136302965">

Re: Evoking Dialogues on Tools from [redacted] on 08.01.2006 - 15:52

hi everyone,

in my bachelor programme I used **"aulis" as a learning platform** and I didn't feel very comfortable with it. I think **StudIP is a lot better** but there's much space to enhance it. I think it could be more clearly arranged and the **first page could show more information more "compressed" and informative**.

Another important aspect is that **not all courses use this tool**. I applied for two other courses and haven't got a final "invitation" yet. So this is the only one of my courses that uses StudIP. If more people would use it so that it would be the general only and always-used tool for managing classes it would have a much bigger meaning for me.

Let's say some good things about StudIP: :)

the functionality is very good and extensive - it just **would be better if it was better arranged and ordered**, anyway it is a good platform to work with and it can be improved a lot and gain to a bigger and much more important platform.

have a nice day

[redacted]<admin_msg autor="[redacted]" chdate="1136733282">

DECLARATION

I declare that, I have carried out this work myself, all literally or content-related quotations from other sources are clearly pointed out, and no other sources or aids other than the ones specified are used.

I also confirm that this doctoral thesis has not been previously submitted or published in any national and international universities.

Bremen, February 2011

P. Priyakorn

Place, Date

Signature