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LEARNING FROM E-LEARNING: EMERGING CONSTRUCTIVE LEARNING PRACTICES

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Abstract

This research is situated within the field of Information and Communication Technologies for Development (ICT4D) and asks if ICT use can make learning practices change. While constructive learning practices are critical to both individual and societal development, repetitive learning practices are the norm in many developing countries. The study is based on observations and in-depth interviews and uses a structurational approach to understand if and how students views of learning change during an e-learning program in Sri Lanka. We found four constructive learning practices that emerged through technology use; individual exploring, interaction with peers, interaction with teachers, and taking responsibility of the learning. Many constructive learning practices emerged outside the LMS used, in students' voluntary uses of publicly available resources on the Internet. The study shows that technology use can play a positive role for development, provided an open environment is available; students learn constructive practices from e-learning.

Keywords: ICT4D, e-learning, learning practices, Structuration Theory, constructive learning theory

Introduction

The research field of Information and Communication Technologies for Development (ICT4D) is concerned with investigating how Information and Communication Technologies (ICTs) can make a difference for development (Heeks 2008; Prakash and De' 2007; Unwin 2009). Development refers to a positive change in one or more of several fields; economic growth, social development, quality of life, human development and freedom for people to make choices in their own life (Sen 1999; Simon 1997; Unwin 2009). Within this framework, this paper focuses on e-learning (distance educations using ICT) and the object of study is students' learning practices. Education is one of the fields where development is urgently needed in large parts of the world, both by bringing education to more people and by bringing better education. ICTs can technically bring educational material to people over the Internet, but can it also improve education, and if so, how?

Technologies used in distance educations can support different pedagogical ideas (Cooper 1993). The pedagogical underpinnings of the first computer learning systems were mainly behaviorist where complex learning parts were divided into smaller chunks of understandable and testable material (Ally 2008; Garrison and Anderson 2003). Reinforcement was provided through feedback indicating whether the answer was correct or incorrect. As more powerful technologies emerged, distance educations could be supplemented by more multimedia, and learning applications were built around cognitive learning ideals (Ally 2008; Garrison et al. 2003). Today, the constructivist school of thought is most advocated in e-learning (Cooper 1993; Garrison et al. 2003; Laurillard 2008; Rovai 2004). The role for educational technology for constructivism, building on the ontological assumption that meaning and knowledge are constructed and shared, is to support interaction, communication and individual exploring. Discussion forums and chats supporting deliberations are important as well as access to many resources, e.g., via Internet and open access databases, for personal exploration.

One of the fundaments of constructive e-learning is that students should be active learners, not passive recipients of teacher-delivered information. In this view, knowledge is not merely transmitted from one container (the teacher) to another (the student) but created by individuals in interaction with others and with learning materials (Dewey 1916; Rovai 2004). The outcome of a constructive learning practice is students that are able to think critically and who know how to continuously learn. Critical thinking is about making reflective judgments about what to believe by having "the ability to synthesize arguments and evidence from multiple sources, sources that often disagree" (Light 2001, p.37). This in turn develops the students' generic skills in how to learn and how to capture an ever changing body of knowledge (Dewey 1916; Garrison et al. 2003; Rovai 2000). Because of this outcome constructive learning practices are believed to be important for development. Development is by definition about change and about doing things in a different way so that change is possible. In order for change to happen we need to dispute assumptions, question the current situation and investigate alternatives. Such a constructive view of learning is not new for e-learning. It has for at least a century been seen as conducive not just to learning itself, but to social development because it brings not just specific information but also the ability of self-directed learning to people (Dewey 1916; Freire 1970; Morrow and Torres 2002). Dewey (1916), one of the fathers of progressive education and constructivism, saw progressive education as a tool for breaking down "those barriers of class, race, and national territory" (Dewey 1916, p.101) and Freire believed it would contribute to progressive changes in society. Similarly, Nobel Price winner Amartya Sen continuously stresses the need for students to be "exposed to ideas from many different backgrounds and perspectives and be encouraged to think for themselves and to reason" (Sen 2003, para. 29). Constructive learning is thus seen as a tool "for engaging people to transform unjust social, economic, and political conditions" (Choules 2007, p. 160). This idea has also been applied to the field of ICT4D; as e-learning becomes more wide-spread it has to be analyzed also from the point of view of not just outreach but also the pedagogy that is used:

There is international consensus that for education to be successful, learning should be an active process that involves collaboration, problem solving and critical thinking with mentor support from teachers. This is in preference to the behaviourist model of learning that is believed to persist in so many countries in which teachers are transmitters of knowledge and students are passive receivers. (Selinger 2009, p.220-221)

In contrast, much teaching is based on the belief that knowledge is an object which can be transmitted to students during lectures (Ramsden 2003). In this view, "learning is about imparting information not about encouraging

critical thinking or even about understanding ideas” (Garrison et al. 2003, p.3). In addition to this, many developing countries have an authoritarian education culture which further reinforces a transmission view of knowledge (Burn and Thongprasert 2005; Pagram and Pagram 2006; Usun, 2004). This is a problem when it comes to introducing e-learning. Students in many countries are not accustomed to learning practices where they themselves are subjects; rather they have been formed by a transmission pedagogy model implemented by very different learning practices. When e-learning is introduced students need to change their learning practices so as to be able to make best use of the new opportunities. Change is not likely to come from within the old education system. Perhaps introduction of new technology and e-learning, which includes a more student-centered approach to learning, could play an important role for developing a more constructive learning practice.

This paper researches e-learning in a developing country with the aim to see if and how the use of technology can work as a catalyst for change in learning practices. This question is important because if technology fails to bring this change, then how will it happen? If the learning practices in developing countries maintain an authoritarian education culture, e-learning will largely be limited to such knowledge that can be transmitted and repeated.

The question of learning practices in connection with ICT use is also understudied. Most studies concerning the value of technology in education are comparative (Bullock and Ory 2000) where e-learning replicates a traditional approach. Outcomes are typically measured in terms of grades, test scores or learner satisfaction where test scores and grades are measured based on “the re-statement of rote-learned facts and static information” (Garrison et al. 2003, p.19). These studies typically find that students perform just as well in e-learning mode as in a traditional classroom settings – something which is referred to as the “no significant difference phenomenon” (Garrison et al. 2003; Halperin 2005; Russell 2001). Such output studies do not measure changes in learning practices, and they cannot measure if new types of knowledge are learned, i.e. self-directed learning, critical thinking, information searching, reasoning skills, i.e. such knowledge that is critical to individual emancipation as well as human capital development. This means we do not know if the use of technology leads to a change in students’ and teachers’ view of knowledge, and hence we do not know if the use of technology is conducive to development in the sense of a step change in education quality. This study addresses this gap in knowledge by focusing on the very processes of achieving knowledge; students’ learning practices. These learning practices are informed by, and affect, student’s norms and interpretive schemes, i.e. the way they think about learning.

The technologies under study are the ones used by students following an e-learning program in Sri Lanka and the ‘difference for development’ refers to a change towards a constructive learning culture. By introducing technology into long-established transmission educational practices, the university program we have followed aimed to change the learning behaviors of students. This study examines to what extent, and how, this happened. It does so by an approach informed by Structuration Theory (ST) (Giddens 1984). In ST terms, human behavior is guided by the structures we enact. The relationship between structure and agency is expressed through norms and interpretative schemes (our beliefs and assumptions), and through facilities available for our daily practices, such as ICTs. This study identifies students’ learning practices and their beliefs and assumptions for the purpose of understanding to what extent, and how, re-structuration towards a constructive view of knowledge and learning has taken place.

The paper is designed as follows. The next two sections briefly introduce learning structures and Structuration Theory respectively, followed by a case description. The method section describes data collection and analysis in view of the structuration approach. The empirical part that follows is organized by the four emerging learning practices we found. The discussion part summarizes the findings and discusses the implications of these in terms of the development perspective motivating the study.

Learning Structures

The traditional transmission model of education is often described as authoritarian where predetermined pieces of information are delivered by a narrating teacher with students as patiently listening objects that mechanically record, memorize and repeat what the teacher says (Dewey 1916; Freire 1970; Garrison et al. 2003). These learning practices typically build on the behaviorist idea that learning outcomes are observable and that students respond to external stimuli. Immediate feedback on performance is seen as vital for learning and this kind of feedback is only feasible when a small portion of learning is being evaluated. Students are expected to work individually, separated from each other, and the only interaction that takes place is between the individual student and the teacher. Paulo Freire (1970) describes how students are seen as empty containers which should be filled and how the teacher’s role is to regulate how the world enters into their minds. In opposing this kind of education, Freire proposes a pedagogy

in which communication and critical thinking are the central concepts. This critical pedagogy is one branch of the wider constructivist school of thought in education.

Constructivism is a theory of learning and builds on the idea that reality is a personal interpretation which is constructed from experience and can be altered and negotiated in collaboration with others (Ally 2008; Dewey 1916; Rovai 2004). Individuals construct knowledge in interaction with the environment and the learner is thus seen as an active creator of knowledge. Constructivist theory furthermore holds that “individuals gradually build their own understanding of the world through experience, maturation, and interaction with the environment” (Rovai 2004, p.80). The constructivist school also stresses how students’ previous learning experiences influence every learning situation, and how students carry these experiences with them throughout the years (Crawford et al. 1998; Ramsden 2003). Dewey (1916) pin-pointed two major pillars for education - continuity and interaction. Continuity refers to the experiences of students which influence all learning and interaction refers to how these experiences influence and are influenced by every learning situation, making every learning experience individual. This in turn calls for flexibility and individuality in learning designs in order to allow for individual differences:

The implications of constructivism for a learning environment include using curricula customized to the students’ prior knowledge, the tailoring of teaching strategies to student backgrounds and responses, and employing open-ended questions that promote extensive dialogue among learners. (Rovai 2004, p.81)

The major ideas at play are thus those of learner-centeredness, individuality, interaction and learners in control of the very learning process. For continuous, long term skills in learning, taking responsibility of the learning is a prerequisite (Garrison et al. 2003; Ramsden 2003).

Table 1 summarizes the two different educational ideals.

Table 1: Summary of the Characteristics of the Different Learning Structures	
Transmission Structure	Constructive Structure
<p>An underlying belief is that knowledge exists outside the learner and that the teacher can put the knowledge into the students, i.e., knowledge is pre-determined and can be transmitted to students. The students’ previous experiences do not matter and quality in learning is achieved through the teacher’s design of the instruction and control of the learning environment.</p> <p>The underlying norm is that the teacher is the one who should teach and that the students should ‘listen and learn’.</p> <p>The transmission structure is often enacted in a classroom where the teacher uses tools such as books, blackboards, computers and beamers, and where students mainly use books, paper and pens. These tools make content available through descriptions in books and through the teacher’s own interpretations (provided through lectures). Technologies in distance educations are used for transmission of information, immediate responses and encouragement (e.g. application saying ‘you were right!’ or stars falling on a correct answer), self-assessments and examinations (typically multiple-choice-questions).</p>	<p>An underlying belief is that knowledge is a personal interpretation constructed from experience, individual exploring and altered through interaction with others, i.e., knowledge is being constructed and negotiated. Quality in learning is achieved through interactivity, participation and dialogue. Meaning is thus shared and previous learning experiences of students matter.</p> <p>The underlying norm is that students should be highly autonomous, active and critical in their learning.</p> <p>The constructive structure can be enacted in class-rooms using the same tools as in the transmission structure, but in a constructive classroom the students are equally involved in the use of all tools. The content made available by these tools is interpreted by both teachers and students in mutual discovery and collaboration. Technologies in distance educations are used for individual exploring (e.g. links, search engines, databases); synchronous and synchronous communication (e.g. discussion forums, chats, SMS, voice); simulations (hands-on-practice) and creation of learning material (e.g. blogs, wikis and virtual worlds).</p>

Structuration Theory

In order to analyze if the use of technology can enable a change towards a more constructive educational structure this research draws on concepts from Structuration Theory (ST) (Giddens 1984) and some of its adaptations to the IS field (Halperin and Backhouse 2007; Orlikowski 2000; Orlikowski 1992). ST is well suited to the problem under

study. The starting point is human action – learning practices – and the relation between human action and larger social structures, in this case pedagogical cultures, is at the core of ST.

ST proposes a description of the nature of human action and social organization where social life is more than the aggregation of individual acts, but at the same time not only determined by social forces. This means that human agency, the ‘capacity to make a difference’, and social structure are interdependent and intimately related, mutually influencing each other (i.e., the duality of structure). A structure consists of rules and resources where the rules are implicit formulas for action, even if sometimes only in our heads; and the resources are what people bring into the action – abilities, knowledge, etc. On an analytical level Giddens identifies three dimensions of a structure; signification, domination and legitimation; and three corresponding dimensions of agency; communication, power and sanction. Signification is about meaning; domination is related to power through control of resources; and legitimation refers to moral orders such as societal norms, rules or standards. This complex relation between agency and structure is inter-linked through modalities referred to as interpretive schemes, facilities and norms (Giddens 1984). These three modalities are the research constructs that are employed in this study and will be further elaborated below.

ST has been widely used in the IS field (Jones et al. 2004; Pozzebon and Pinsonneault 2001; Rose 1998). A count of published articles between 1983 and 2004 yielded as many as 331 IS articles drawing on Giddens’s work (Jones and Karsten 2008). ST is, however, at a very high level of abstraction and has often been criticized for being hard to understand and hard to apply empirically (Halperin et al. 2007; Jones et al. 2008; Pozzebon and Pinsonneault 2005; Rose 1998). Due to this, and because Giddens in his description of ST never mentioned technology at all, the field was open for IS researchers to interpret the concept of structure in relation to technology in many different ways. The IS field has thus made some theoretical development of the theory in order to better fit it to the technology field. Examples include the Duality of Technology model, the Practice Lens by Orlikowski (2000; 1992), and the Adaptive Structuration Theory by DeSanctis and Poole (1994).

This study builds on Orlikowski’s framework for analyzing the structure ‘technology-in-practice’ (Orlikowski 2000) and its elaborations made by Halperin and Backhouse (2007). Orlikowski (2000) in her IS-specific version of ST translates the modality of facility to the hardware and software used; norms into the protocols, rules and etiquettes in using the technology; and interpretive schemes to assumptions and knowledge related to technology use. By positioning technology as a facility in the structure ‘technology-in-use’ she emphasized that technologies do not have structures embedded in them, but that it is human action that contains and reinforces structures through repeated enactment. It thus follows that if we want to find out if there is a difference in practices due to technology then we have to study the *use* of technology. Since we are interested in learning practices that emerge through the use of technology we can describe e-learning as a technology-in-practice where constructivism could emerge as a pedagogical structure. In order to understand the nature of the emerging learning structures we thus need to understand the use (or non-use) of technology by identifying the reasons behind it. We do so by identifying facilities, norms and interpretive schemes drawn upon in action. *Facilities* here refer to the technologies used for learning broken down into each relevant function (e.g. search engine on the Internet, discussion forum in the Learning Management System (LMS)). *Norms* refer to what is the accepted behavior, the ‘shoulds’ and ‘should nots’ in a learning situation (e.g., students should share knowledge, students should not talk in class). *Interpretive schemes* refer to the students’ assumptions and beliefs about their learning practice (e.g., beliefs about how learning takes place, beliefs about the usefulness of a LMS forum).

Case Description

This research is based on an empirical case study on an e-learning program in Sri Lanka called eBIT (External degree of Bachelor of Information Technology). The program is run by the University of Colombo School of Computing (UCSC) and more than 18.000 students have registered since the start. In 2008, during the time of our investigations more than 3.000 students were enrolled. eBIT covers topics from basic computer operation skills to IS development process and project management. The eBIT program has been in operation since 2000, but it was not until year 2003, with the assistance from the European Union and Sida (Swedish International Development Cooperation Agency), that e-learning was introduced through a LMS. This LMS assisted students in learning through self-evaluating quizzes and collaborative learning, using group assignments. Since 2006, with further assistance from donor agencies, UCSC gradually extended the e-learning facility and a new LMS (Moodle) was introduced, including student manuals and materials, different forums for discussions, quizzes, video lectures and interactive java applications. Further support is given to eBIT students by the regular TV program “Forum for BIT”

which is telecast over TV Lanka. The students can chose to follow the eBIT-program by self-study or by going to learning centers teaching the eBIT curriculum. eBIT is a 3 year, full-time, program divided into six semesters.

eBIT drop out rates were initially extremely high (Hewagamage et al. 2005; Stockholm University 2004) and the aim of introducing e-learning and a LMS was to drastically increase the number of graduating students by introducing “collaborative pedagogical methods and by making effective use of e-learning” (Stockholm University 2004, p.2). Other aims were to provide education to rural parts of Sri Lanka and to “facilitate the paradigm shift from teaching to learning” (UCSC 2004, p.4). From a pedagogical perspective, the eBIT learning activities support both the transmission tradition and constructive approaches to learning. The assessments and diagnostic quizzes mainly build on immediate responses of smaller bits of knowledge such as facts and formulas (i.e., supporting the transmission structure), whereas discussion forums, chats and problem-based tasks enable a more constructivist learning. Most students in our study use a blended learning tactics mixing their self-studies with going to learning centers. Learning centers are used as Internet access points but also for lectures.

Method

The object of study is learning practices. This means that we must identify practices as well as understand why students engage in them and how they themselves view them. In particular we are interested in changes in how they think of the situation they are facing in the e-learning program, compared to their views of traditional education. The research is interpretive (Walsham 1995). It is based on an empirical case study on e-learning in Sri Lanka where students were observed and interviewed. The number of interviewed students is twenty-three of which ten were female and thirteen male. Nine students where interviewed individually whereas the others were interviewed in groups. Observations covered a larger number of students as everyone who was present at the learning centers were observed along with the target twenty-three people chosen for the interviews. Learning practices, and changes over time in practices, were identified not just from these students but from a quantitative study (n=1785), reported by Author 1 (Andersson in press). From that study we saw that changes in learning practices were actually happening on a large scale, which indicated that student and teacher roles were changing. The present study was done to understand the nature of these new practices. To that end we used both interviews and observations. In-depth interviews provided a rich picture of how students perceive their past and present learning practices. Observations informed the interviews so these would not rely solely on students’ self-reported activities but on actually observed behavior. The empirical material was thereafter analyzed by using ST, as adapted by Orlikowski (2000; 1992) and Halperin and Backhouse (2007). More specifically we use ST to analyze:

- Students’ beliefs and assumptions (interpretive schemes) about their learning practice – past as well as present. This includes analyzing students’ views on what effective learning practices are and the role students ascribe to technology (since technology is assumed to be an important change agent).
- Students’ social rules or normative conditions (norms) stipulating the adoption of a certain learning practice.
- Which technologies (facilities) students use, and how they use them, in manifesting these norms and beliefs.

Data Collection

The eBIT case was chosen because technology was explicitly given a very central role as catalyst for pedagogical transformation. Author 1 has done several evaluations of the project over a period of three years (2006-2008). Even though she has worked closely with the project members, her role in relation to the students interviewed for this paper was that of an ‘outside observer’ (Walsham 1995).

Interviews and observations took place in April and December 2008. Twenty-three students registered with eBIT during the time of investigation) were interviewed. Six students were beginners whereas others had been in the program for several semesters. Fourteen of the students were interviewed at different learning centers in Colombo (the capital city), six were interviewed at the BIT office and a further three were interviewed via e-mail. Interviews lasted 30-60 minutes and were semi-structured using an interview guide. This was not used strictly since a main point for understanding how people think is to let them describe their experiences and thoughts as far as possible in their own words and by their own logic. The interview- and observation guides were informed by the guide on empirical data collections for ST-studies as provided by Halperin and Backhouse (2007).

The constructivist approach suggests that students' previous learning experiences influence the present. This together with the very notion of emerging structures, which builds on the idea to track structuration processes over time, made it important to interview students about their past as well as present learning practices. Our study of changes, the comparison between 'before' and 'now', is done through the students' own examples. The study takes place in a setting where students have relatively recently been confronted with e-learning. Even though some students have been in the program for several semesters, their formative educational experience comes from traditional education as this is what they all have met since compulsory school. The relation between their actual current practices – in e-learning – and their norms and interpretative schemes are at a formative stage or have very recently been restructured. Several e-learning practices have been forced upon them, and many are still struggling with understanding them. This means that their old norms and interpretative schemes are challenged and they are actively concerned with making sense of, as well as good use of, the new situation.

Examples of questions that were asked were: Can you describe what the education was like when you grew up? How did you learn? What specific activities did you undertake to learn? Is there a difference in how you learn today? What is the major difference with e-learning if compared to traditional classroom teaching? How do you learn today? Which specific activities are you doing to learn? How is knowledge gained?

The students' stories were validated through complementary data sources, i.e., triangulation (Patton 1990). Five observations at four different learning centers captured the actions of students in using technologies for their learning and were documented in field notes. During the interviews it was evident that the introduction of technologies to education made e-learning a norm of its own. It took some effort to make clear what the students' truly own beliefs were and what they thought they were supposed to say. This required several follow-up questions and references to the observed behavior. Some students missed the traditional learning practices and were embarrassed to say so. Hence they often started out with claims that they embraced the ideals of e-learning, but as the interviews progressed and more detailed questions were asked many students started contradicting what they had initially said. In some cases they were confronted with examples of contradictory behavior, and so their views could be revealed and discussed. The following example illustrates this process.

Interviewer: I basically want to ask you about e-learning

[Student (Respondent 1) interrupts]: I think it's better compared to traditional teaching, we can ask so many questions and we can check them also and ask other parties. The forum is there.

Interviewer: So you use the LMS?

Student: Yes

Twelve minutes later the same student talks about how we met at the learning center and when he is asked about why he needs to go there he gets very defensive:

Interviewer: So you go to learning centers as well. Do you need those lectures you attended?

Student: I do not think so.

Interviewer: Why do you go there then?

[Student is quiet]

Interviewer: I am asking because you said you could talk to your friends and that you learnt most on line... if you would not have gone to the learning center do you think you would have passed the exam?

Student: I don't think so.

Interviewer: Why not?

Student: I am not satisfied with self studies.

Interviewer: Why not?

[Student is quiet, looks down and seems embarrassed]

Interviewer: It's not a trick question... you can...

[Student interrupts and answers in an irritated voice]: I can't tell actually. Exactly I can't tell you! I think that through that we can get some better information. That is why.

In this way the observations were used to inform interviews.

Data Analysis

The data analysis was informed by the methods and frameworks provided by Halperin and Backhouse (2007) and Halperin (2005). The material used for analysis was field notes from the observations and the interviews describing and discussing past and present learning practices. This material included information about which facilities the students had used as well as their personal beliefs and assumptions.

Transcripts from the interviews and notes from the observations were read and the first conceptualization began with making notes in the margins of these documents. During the analysis we identified past and present learning ways of learning, the role of technology, as well as the students' norms and beliefs regarding learning and knowledge development. The evidence of emerging patterns was collected in separate documents labeled, respectively, 'description of traditional structure'/'how they used to learn', 'major difference with eBIT'/'how they learn today', 'use of technology', and 'role of technology'. For the purpose of making sure the material was systematically handled these documents were assigned to a computer-aided tool for qualitative analysis. The analysis identified norms (values and 'shoulds') and interpretive schemes (beliefs and assumptions) in relation to the learning practices described by students, as well as the role of technology. The interpretive schemes we wanted to capture concerned underlying beliefs about learning in relation to how one learns, and which learning practices that are effective (and if technology can contribute to effective learning practices). As an example of how the interpretations were made we use a part of the transcripts where a student describes how he learns:

During discussion times I try to get a good knowledge in the modules. If we deeply discuss with others and share what we have – even if it is wrong or not – and go through for the new ideas or any important parts that are not included in the syllabus. We should join with the group studies and share the knowledge with them.¹ (Respondent 15)

An emerging norm in this statement – not present in students' descriptions of their earlier education – is that you should share – “We should join with the group studies and share the knowledge with them”. The student also reveals something about his interpretive schemes which this norm draws on. He mentions two aspects of that. First, that knowledge is seen as being constructed and negotiated – you “get a good knowledge” if you “deeply discuss with others and share what we have”. Second, that knowledge is seen a relative and not fixed – you should share “even if it is wrong or not – and go through for the new ideas”.

For identifying previous learning practices that the students had grown up with we used self-report information. This was quite natural as students were in a process of changing their learning practices and in doing so were very observant on changes as compared to their previous experiences from education. In identifying learning practices that students enact today, categories of present norms and interpretive schemes were extracted from interview transcripts and documentation from the observations. The combination of observed practice and reported beliefs, values and norms increased the validity of the interpretations. For example, a claimed belief that peer collaboration is “an important part in the learning process” was also manifested in observed activity when we followed collaboration in the students' discussion forum.

All in all, the twenty-three students drew a unison picture of both their past and present learning practices. All learning practices described in this study have been addressed by a majority of – and in most cases all – the interviewed students. There were neither any major discrepancies in how these students described their feelings towards a certain practice, nor any direct dissenting arguments found (still bearing in mind that all practices were not addressed by all students). Quotations chosen for the upcoming analysis have been selected to represent the full group of students' typical expressions and wording.

¹ Quotations selected for illustration of students beliefs and opinions have occasionally been tightened in order to make the point clear and some grammatical and syntactic errors have also been corrected.

Students' Previous Learning Practices

As a way of achieving an effective 'baseline' we asked the students about their previous learning experiences, practices as well as beliefs. They paint a picture very similar to the transmission model described above; the teacher was always in the center and s/he was also the one doing all the work:

Normally in schools we had teachers with a black board or a white board. Then he goes to the white board and writes everything. [...] That's the culture that we follow in the school and in the campus as well. [...] In Sri Lanka the teacher has the most important role. He is going through everything in the book and does much more things than the students. The student studies first for the exam. [...] Teachers give you everything and we are not searching anything and we just learn what they say. (Respondent 1)

The norm was face-to-face teaching and it is very clear that it was the teacher who should do all the teaching. The teacher was the only one that was active except for a short time before the exams when students started studying what the teacher had told them to study. The belief was that knowledge can be given to students by the teacher, almost like a gift. It was also found that the teacher's role in traditional classes was to regulate how the world enters into the mind of the individuals by not only giving the students the teacher's interpretation of what s/he has read in a book but also by writing the very short notes that students should take during lectures:

In Sri Lanka that's the system, that's the way. Because all teachers are giving everything... even short notes, the theory. Actually students are doing very little. Almost everything is given by the teachers, you know. I think that's not the way it should be. We have to find information from the Internet and we have to refer books. And we have to make short notes... those are the ways, but in Sri Lanka the thing is very different. The teaching ways are different there. It should be changed, you know. [...] It's really old methods and it's not suited for this new millennium. I think we have to get the knowledge, but I think almost all like to be taught by a teacher. I also like that. Because I don't think I have time to get the information and I don't have time to refer books. It's easier to be taught by a teacher, but it's not good. (Respondent 6)

This student is aware that his way to learn is not effective - "I think that's not the way it should be", "it's not good". The belief does not seem to be that knowledge is generated this way, by repetition, but still it is seen as an easier and more efficient way to pass school. One important reason given is to do with the assessment methods – which are based on repetition – and what kind of knowledge that is assessed. Understanding of a subject was rarely assessed but rather the passive repetition of words or formulas. Students are usually very quick at finding out strategies for passing exams (Ramsden 2003) and thorough understanding was not rewarded in assessments:

Because any one who can memorize the syllabus and content can pass them [the exams] surely. (Respondent 14)

When describing how they used to learn in the traditional environment the great majority of students described it as they learned by listening. This learning practice drew on the norm that students should not talk or question what the teacher says and the belief that knowledge can be transmitted to students. In the terms of Freire (1970) the analysis shows that the teacher was seen as the container of knowledge and the students as empty vessels waiting to be filled with knowledge.

Bearing these descriptions of previous practices in mind we will now turn to the main focus of this study concerning if any constructive learning practices emerged with e-learning.

Emerging Constructive Learning Practices

Two categories of constructive learning practices emerged as a result from the use of e-learning: individual practices and collaboration practices. The individual practices include student responsibility and exploration of learning materials and methods, which are cornerstones in a constructivist learning practice since they foster students in how to learn and become self-relying individuals. The collaboration practices include peer-to-peer collaboration and increased interaction with teachers. From a constructive pedagogical perspective these practices are fundamental; in order to construct meaning students need to test and process their meaning "collaboratively within a community of learners" (Garrison et al. 2003, p.13).

Individual Practices

Individual exploring emerged as an important learning practice illustrating the value of being an active student in a constructive, student-centered approach. This is manifested through new demands on students to be responsible for their own learning, and by individual exploration through students' use of and search for alternative and different learning materials.

Increased Student Responsibility

The use of technology has shifted the responsibility of learning from the teacher to the student. Students are more active and search for information themselves, and although students find it hard and requiring more effort most of them believe that they learn more. Two girls explained this during a group interview:

Here we have to study by ourselves a lot and we have to search for information a lot and previously we did not do that. We only get the main points here the rest we have to do by ourselves. We have to learn more about the subjects by ourselves. It's a little hard but we learn more, I think. You know it goes to mind. (Respondent 10)

The second girl continues:

Because when the teacher gives everything you do not have to think, you do not have to use your brain, he or she gives everything. But here we have to study on our own. We get more than that because we try to understand it by ourselves. But it's harder! (Respondent 11)

These descriptions make clear that the students, even though they think it is harder, believe that these ways of learning are more efficient and lead to deeper knowledge – “it goes to mind” and “we get more than that”. Students now believe that they need to be active in order to learn, whereas their previous experiences were that the teacher was the one doing all the work. The use of e-learning where students are responsible of the learning process has improved the possibility for the students to direct their own learning. This is visible, for instance, in how they plan their studies, and how they relate to the learning content. The students enjoy the increased flexibility of pace that e-learning provides:

If I am in a traditional class I have to follow that lecturer. I have to go on his pace, in his speed. So if I am doing self study I can control my learning speed. So that opportunity is there. Maybe you have 1-10 chapters and maybe I'm familiar with chapter 1 and 2 and I can skip those chapters and start with 3 or 4, 5, 6 and onwards. But in the traditional environment you can't do that, no. (Respondent 1)

Individual Exploration

The introduction and use of e-learning has increased the students' access to alternative learning materials and learning content related to the course. Students find it rewarding to have other sources for information than the teacher:

We haven't that much of Internet and facilities like that. But I'd like to go to that new way of studying. [...] I like also to do like that, to study like that, because in traditional classrooms we only get what the lecturers are telling and if you use computers we can search for information also. (Respondent 4)

This idea of finding your own information through personal exploration and not being dependent on the teacher's information is a recurring theme. There is also much evidence that the students think this is a better way of learning which reveals a norm that effective learning practices require the students to be active. Knowledge is created within a student and by herself and not put into her mind by a teacher. Students' individual exploration is made possible through the introduction of new facilities such as the Internet. Earlier it was much more cumbersome and difficult to search for information, but now as information is only a key-stroke away; learning through individual exploration is not only encouraged, but also seen as a natural part of e-learning. This way of making students themselves find information is essential for a constructive learning practice. Here learning is something that students take responsibility for themselves; learning is not limited to the specific content, and it is important to learn how to learn.

Collaboration Practices

During the interviews and observations two collaboration practices were identified: interaction with teachers and interaction with peers. The change in teacher interaction is reflected in a different teacher role where the teacher to a much higher degree than before has to take on a role as a coach, probing and helping the students find the answers themselves, rather than as someone who delivers the right answers. In the constructivist learning practice, the students also have developed a different view of the role of their fellow students. They are here seen as learning partners, together with whom knowledge is co-constructed in dialogues and discussions.

Increased Interaction with Teacher

In a constructivist learning practice the teacher is highly interactive and encourages questions from the students. In our study we found that teachers in Sri Lanka are taking up such a role. One student described it as:

We can directly ask the teacher questions. They tell us ‘please, ask some questions from us’ that is the main difference. The teacher is more interactive. (Respondent 9)

Interaction with teachers takes place physically in the classrooms but also via e-mail and discussion forums.

There are teachers that are also submitting some questions in the forum. He can log into the forum, he can e-mail us questions also and we can submit questions to them also. They are posting us and on Fridays at 10-12 they are logged on to this LMS so we can ask them questions directly through the net. (Respondent 8)

The quotation below shows that while students still need a teacher to explain things for them in order to learn there is a difference in the communication. In the new learning practice the initiative to learning, the questions and probing, comes from the student:

In my fourth semester one of my friends asked ‘can you show me and can you teach me?’ and actually when I’m teaching him I understood that I hadn’t understood, that I didn’t have a clear idea about that. So after that again and again I asked from the lecturer ‘can you please explain this’ ...so after that even I got it. (Respondent 11)

Students were also observed to be more active and taking more initiatives during lectures and the relation between the student and the teachers have changed tremendously compared to their previous experiences:

In our primary level they talked, they taught us and we listened. If they teach wrong or right we have to accept that. It is this kind of situation. Now we can argue with them, argue with teachers. Also in lecturing style there is a difference. This lecturing style is more for students because students can search anything and maybe a student has more knowledge than lecturers in some field so the student can go back to the lecturer and argue with him and get more information about that field. So these lecturers are very different from our primary teachers. This relation is very close and very friendly. (Respondent 12)

In citations like these the constructivist view on learning is seen in how the students believe that they through arguing are co-constructing knowledge with the teachers – “argue with him and get more information”. The lecturing style is also seen as learner centered, it “is more for students”. The role of the teachers is changing from a transmitter of knowledge to a discussion partner, and knowledge is created through interplay which indicates a more constructivist view on learning. In terms of ST, reflecting the view of humans as capable agents shaping the structures they enact, it is clear that students by enacting the e-learning practice, at the same time reshape the traditional structure. In the traditional structure, here symbolized by the lecturing at the study centers, students are now starting to question the teachers’ words because they have found alternative sources of information on the Internet. At the same time teachers are beginning to encourage students to question what they are saying, showing that also the teachers are starting to enact a different structure with characteristics from the constructive structure.

Increased Interaction with Peers

Peer collaboration has emerged as an important way of learning, and peers have generally gained a more important role in learning. Peer interactions enabled by technology did not so often emerge in the assigned LMS, but rather

through many other uses of Internet. Some students have created their own discussion forums and all use Facebook, MSN Messenger and Google Groups for communication:

Student (Respondent 7): We use both forums – the LMS forum and the classroom forum as well.

Interviewer: When you created it was it because you needed to talk outside the learning center or why...

Student: The teacher told us that we could create a personal e-mail group, but we went beyond that and created a web forum instead.

Interviewer: Are there many discussions in this forum?

Student: There are discussions. We are all registered on that forum and we are having discussions. We discuss about the Dreamweaver software and some of the LMS questions. If we don't know we put them in that forum and then there are answers ...even in the LMS forum we have that feature – if we don't know what is this then we submit it to the LMS and we get the answer.

Interviewer: So you help each other? Do you cooperate a lot?

Student: I think some do the LMS assignments together, by using each other, helping each other.

Another student pointed out that technology enables him to work closer with his friends, and that he believes that knowledge is better gained when it “comes from different ideas” and that he by sharing knowledge can “gain more knowledge”:

The students working together are important parts in the learning process. But some time it is not possible to follow the courses - I could not contact or share the information in classroom because I am in the rural area and my friends are living in the city. So I could not contact them easily. But I can chat or mail them via the Internet or the discussion board. [...] I can feel that better thinking comes from knowing different ideas from others. I try to be close to my friends to share the knowledge and gain more knowledge from others. (Respondent 15)

It is evident in our study how important the use of e-learning technologies has been for facilitating peer collaboration and the development of a constructivist learning practice. The students not only use the forums provided by the LMS, but were observed to also use a number of different technical facilities, such as Facebook, MSN Messenger and Google Groups. Through the use of these technologies the students have created new and complementing arenas for collaboration where knowledge can be shared and created together with other students. These arenas are possible to access even for students living in rural areas (depending on their access to Internet). Collaboration and sharing knowledge with peers is an important aspect of a constructive learning practice.

Summary of Emerging Constructive Learning Practices

Constructivism builds on the theory that knowledge is a personal interpretation which is constructed from experience and can be altered, or negotiated, through collaboration and interaction with teachers and peers. The role for educational technology, under the constructivist view, is to support interaction, communication and negotiation, but also individual exploration. Discussion forums and chats supporting deliberations are thus important as well as access to many resources for personal exploration. In this study we found four emerging learning practices that are by nature constructive and that employ resources in constructive ways. The practices not only exploit resources provided directly by the e-learning program; general resources on the Internet also proved very important and were sometimes found better by the students. Access to Internet and search engines made information searching and gathering possible. This not only enabled individual exploring, but also made students more critical towards what the teacher said by means of being able to access alternative sources for information. Interaction with teachers and collaboration with peers was enabled by e-mail, chats and discussion forums which made ideas or thoughts exposed to further elaborations and validation (abiding to the view that knowledge is created and negotiated). The emerging learning practices, a result from the comparative analysis of the ways of learning before and after the introduction of e-learning, are summarized in Table 2 together with a structure analysis of each practice. The emerging learning practices consist of individual exploring, taking responsibility of learning, interaction with teacher, and interaction with peers – all important ingredients in a learner-centered, constructivist, approach.

Table 2. Summary of Emerging Constructive Learning Practices, Students' Reasons for Choosing them and an Analysis in ST Terms

Learning Practice	Students' Reasons	Structure Analysis
Individual practices: Taking responsibility of learning; Individual exploring	The students use technology to find alternative sources of information because they believe that they need to be active in order to learn: "Students have to do something when they are learning", because then "it goes to mind". The students also like to find alternative sources on the Internet because it makes them less dependent on the information provided by the teacher; they are now owner of the found information/knowledge: "students can search anything and maybe a student has more knowledge than lecturers in some field".	The <i>norm</i> is that students should be active. This norm is based on the belief that students learn more if they are actively searching for information. In doing so they mainly draw on technical <i>facilities</i> such as search engines on the Internet. The <i>interpretive scheme</i> is that knowledge is created within a student, through his own efforts, and that it cannot be put into the student by a teacher. The teacher is no longer seen as the container of knowledge.
Collaboration practices: Interaction with teacher; Interaction with peers	Students interact with teachers on their own initiative and guided by their own plans, because they have questions or ideas that they need to discuss, especially if they have got stuck: "I understood that I hadn't understood, that I didn't have a clear idea about that. So after that again and again I asked from the lecturer 'can you please explain this'". They also interact with teachers because they believe that through discussing they are co-constructing knowledge with the teachers - "argue with him and get more information". Students are also collaborating with peers because they have questions or ideas that they need to discuss and because they want to take part of other students' ideas. They believe that "students working together are important parts in the learning process" because "better thinking comes from knowing different ideas from others."	The <i>norm</i> is that students should interact in dialogue with the teacher because the <i>interpretive scheme</i> is that knowledge is created through interplay and dialogue where the teacher has the role of a discussion partner. The technical <i>facilities</i> used for this interaction are mainly e-mail and discussion forums. The <i>norm</i> is also that students should interact and dialogue with peers due to the <i>interpretive scheme</i> that knowledge is created through dialogue and negotiation. Knowledge can and should be shared in order to grow. The technical <i>facilities</i> used for this interaction include discussion forums, blogs, wikis and chats.

Discussion

As students, as well as teachers, are exploring new ways of interacting and learning with the help of technology, learning practices become increasingly constructive, allowing for a more student-centered way of learning. Constructive pedagogical theories propose that knowledge is created through collaboration and interaction with others, and that students should be active, critical, and in control of the very learning process. Within this constructive framework we have found four practices that emerged through technology use. The two individual learning practices illustrate how students take more responsibility for their learning, and how they, with the help of technology, explore different learning resources. The two collaboration practices show how the students interact with peers and teachers via chats and discussion forums. Together, the four learning practices illustrate the constructive pedagogical ideas - how students see knowledge as negotiable, how they develop a more critical attitude towards their teachers, and at the same time take more initiatives.

The individual learning practice in the transmission learning structure was face-to-face learning where knowledge was seen as something the teacher 'has' and can 'give' to the students. In the emerging constructive learning practice students have to be more active, and although it is seen as harder, the students find this way of learning more rewarding. Interaction with teachers was very limited in the transmission learning structure and there was no evidence of any interaction with peers. In the emerging e-learning practice, however, interaction with peers as well as teachers developed as a normal and daily activity. Interaction became a very important way of learning.

Our study showed that this transition involved some agony. Some students still saw the earlier practices as a shortcut. Self-directed learning was seen as requiring more work from them, and more complicated work. Even so, they had embraced the new learning model by working out ways to cope and ways to benefit from the new situation. This is how structuration should be understood; it is not a theory-driven approach to change but a complex interaction involving several factors. Students' ambition is one, available technology another. The ambition of the program organizers is a third, which should not be underestimated. Even though many of the new practices developed outside the LMS, the idea of self-directed learning was clearly guiding the program from the start.

The study also showed that technology has made more ways of learning possible. This allows for more individuality which is also in line with the constructivist theories of learning. When describing previous practices students only gave one option when describing how they used to learn (e.g. 'listen to teacher' or 'read') whereas now when they describe their current learning behavior within the eBIT they typically provide several ones:

Student: So I think the internet, the books, the classroom activities... they are the environment of learning everything. I am using all the materials. The teaching materials - even the net and the books ...I am using all the materials that I can get. (Respondent 7)

Interviewer: How is knowledge gained?

Student: Knowledge is coming through several areas: lectures, E-books, Video tutorials, discussions with friends etc. Most of the time I use www.W3schools.com, www.wikipedia.com and other learning web sites. (Respondent 14)

The findings thus indicate that the use of technology does, in some regards, have the possibility to transform students learning practices; however, not by determination inherent in technology but by the way it is implemented. It is important to point out that it was not so much the use of the assigned learning technology (i.e., the LMS) that caused the changes, but rather the use of various media, and Internet in particular, for information gathering. The use of Internet has, above all, given the students' other sources for information than the teacher and provided more places for interaction and thus enabled more peer collaboration.

In terms of the development perspective presented earlier in this paper we can clearly see some positive potential in relation to the emerging learning practices. In this perspective the emerging constructive learning practices are positive as they indicate a qualitative change to education. While some earlier studies measuring learning outcomes in terms of the ability to memorize pieces of information have not found e-learning better than traditional learning, our study has shown that students learn something more; they learn constructive learning practices. In terms of constructivist educational theorists this is a step towards social and human development, for two reasons. For the individual student it is emancipating. For countries it is developing because students become more active, innovative and critical. We have shown that while these practices were not in any way determined by technology, they were at least enabled and facilitated by it. It is necessary that the technological environment is sufficiently rich and open. We saw that students often found the most interesting information and tools outside the predefined LMS. This means that limiting the available environment to what is in a LMS is likely to be counterproductive. In many countries access to Internet is limited for political reasons. Also many e-learning providers try to make self-contained systems and confine students' activities to the content of the LMS. Whatever the reasons may be, from the perspective of enabling constructive learning practices, allowing students access to the full Internet seems both most economical and most conducive for change.

In relation to the analysis we believe it gained in explanatory power by using ST's concepts of norms and interpretive schemes. ST provides a good framework for a rich understanding of why students believe that a certain learning practice is efficient or not by revealing the underlying assumptions about how one learns. Separating norms from interpretative schemes provides for nuanced explanations of students' actions and thinking. For instance, we found a disharmony in students' descriptions of their learning experiences, past as well as present. While there was earlier a strongly sanctioned norm to 'listen and learn' some students did not believe that this was a good practice and the practice was thus in contrast with their underlying beliefs about effective learning. As concerns present practice, demonstrated in the example in the Data collection section, we found a strong norm to be that you *should* not need a teacher for your learning. Also this norm was in disharmony with the student's stated belief, something that was evidenced through the observation of the student sitting for a two-hour lecture. In this way ST provided us with a tool for sorting out behaviors easily misunderstood or not understood at all.

Whereas ST has often been criticized for being too abstract for empirical application, this study has shown its usefulness for just that. Encouraged by the operational approach suggested by Halperin and Backhouse (2007) we

have met the challenges of ST being at the same time voluminous and underspecified. Furthermore, by following the tradition of those IS researchers who view structures as emerging from technology use (e.g., Halperin 2005; Jones 1999; Orlikowski 2000) - as opposed to those who see structures as embodied in technology - this study identified many various uses of technology. If we, for instance, had decided to limit our study to the use of the LMS and not look at the wide range of technologies used by the students, the findings would have been very different since we found that the assigned LMS did not account for all uses that made a difference. Instead, by taking the starting point in what learning activities students use *any* technology for we found many different uses of different technologies that structured the students' minds.

Conclusion

This study set out to find out if and how the use of technology can enable a change towards more constructive learning practices. We found four constructive learning practices that emerged through technology use:

- individual exploring of learning materials and tools, including alternatives to those provided by the program organizers;
- interaction with peers for the purpose of better understanding;
- increased interaction with teachers, induced by students' needs and learning strategies;
- self-directed learning: taking responsibility of the learning and 'taking the lead' in the knowledge creating process.

These four practices are at the very core of constructivist theory on how learning takes place – students individually and collaboratively explore, interact to create meaning, and take responsibility of the learning. Well in line with the constructivist idea we further found the use of technology to enable a more varied repertoire of learning activities which allows for more individuality. Students no longer see just one best learning practice, as they did previously under the old practice of 'knowledge transmission', but rather a repertoire of tools and materials open to exploration which they exploit according to their own learning needs, ambitions, and ability. At a more general level we found students being more reflective about their learning and educational situation. We found that many constructive learning practices emerged outside the LMS used, in student's voluntary use of publicly available resources on the Internet.

From a development perspective the emerging constructive learning practices are positive as they indicate a qualitative change to education: provided a sufficiently rich and open environment is available, students learn more than specific pieces of information, they learn constructive practices from e-learning. According to constructivist theory such practices should be seen as a step towards social and human development of not just the students themselves but also for countries by means of creating more active, innovative and critical students. We have shown that these practices were not entailed but enabled and facilitated by technology. The study hence contributes to the literature by showing how technology – properly applied – in education can play a positive role for practices conducive to development.

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